ISSN 0377-9335

ENTOMON

Vol. 40 March 2015 No. 1

CONTENTS

Page

Melissopalynology studies on the Indian honey bee *(Apis cerana indica* Fab.*)* in southern Kerala
S. Aswini, V. S. Amritha and S. Devanesan 1

Optimization of media and temperature for antimicrobial activity of *Enterobacter* sp. associated with entomopathogenic nematode *Rhabditid* sp.
B.G. Sangeetha, C.A. Jayaprakas, J.V. Siji and C. Mohandas 11

Agriculturally important Pyraloidea (Lepidoptera) of India: key to subfamilies, current taxonomic status and a preliminary checklist
M. Shankara Murthy, S. K. Nagaraj and A. Prabhuraj. 23

ASSOCIATION FOR ADVANCEMENT OF ENTOMOLOGY
Department of Entomology, Kerala Agricultural University,
Vellayani PO, Thiruvananthapuram 695522, Kerala, India
E mail: aae@kau.in; web:www.entomon.in

ENTOMON

ENTOMON is a quarterly journal published by the Association for Advancement of Entomology devoted to the publication of research work on various aspects of insects and related branches of Entomology.

Address all MS and editorial correspondence to the Chief Editor, ENTOMON, Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram 695 522, Kerala, India. E mail: ***editor.entomon@kau.in***

SUBSCRIPTION RATES
Annual subscription for Institutions: Rs 3000/- (in India); US$ 300/- (out side India)
Annual subscription for Individuals: Rs 1000/- (in India); US$ 150/- (out side India)

1. All remittance to the Journal or Association for Advancement of Entomology should be sent to the Secretary or Treasurer by bank draft a/c payee drawn in favour of Association for Advancement of Entomology, payable at Vellayani, Thiruvananthapuram. The amount can also be transferred directly to the account of Association for Advancement of Entomology in the State Bank of Travancore, Vellayani, Thiruvananthapuram 695 522, Kerala.

2. Request for copies of ENTOMON should reach the Secretary, Association for Advancement of Entomology, Department of Entomology, Kerala Agricultural University, Vellayani, Thiruvananthapuram 695522. E mail: ***aae@kau.in;*** Web: ***www.entomon.in***

ENTOMON is covered in the following abstracting/ indexing journals: *CABI, Chemical abstracts, Review of Applied Entomology, Science citation index, Current contents/ Agriculture, Biological abstracts, New Entomological Taxa, Referativny Zhurnal.*

Entomon 40 (1): 1-10 (2015)
Article No. ent. 40101

Melissopalynology studies on the Indian honey bee (*Apis cerana indica* Fab.) in southern Kerala

S. Aswini, V. S. Amritha* and S. Devanesan

AICRP on Honey Bees and Pollinators, Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram 695522, Kerala, India
E mail: amritvs@gmail.com

ABSTRACT: Melissopalynology studies of the Indian honey bee (*Apis cerana indica* Fab.) in southern Kerala was undertaken to study the potential pollen and nectar sources of Indian honey bee across the seasons in southern Kerala. A detailed characterization of all the honey and pollen samples showed the presence of 69 different pollen types; of which twenty four pollen types were identified up to species level. They were distributed among 19 families of these, the pollen types from the families of Arecaceae (3) and Asteraceae (3) were best represented in honey and pollen load samples. Honey bees were found to collect pollen from the tall trees (*Cocos nucifera*) as well as the small plants (*Mimosa pudica)* irrespective of their height.

Key words: Melissopalynology, *Apis cerana indica*, *Cocos nucifera, Mimosa pudica*

INTRODUCTION

Beekeeping is an agro based enterprise where honey bees are utilized to harvest nectar and pollen from the plant sources to produce honey and other hive products. Though most plants in the ecosystem produce nectar and pollen, all of them do not form the honey source. Hence, recognition and initial screening of various bee plants representing potential sources of nectar and pollen for honey bees throughout the year is an important prerequisite for launching apiary industry in any locality (Kalpana and Ramanujam, 1997). Melissopalynology is one of the applied branch of palynology that deals with the microscopic analysis of the pollen contents of honey and pollen loads of a location. It provides reliable information regarding the different flora which will help the bee keepers to frame proper management practices

* Author for correspondence

during dearth periods (Ramanujam and Khatija, 1991). Moreover, pollen analysis in honey can provide information on geographical and botanical origin of honey to a certain extent.

Melissopalynological studies, thus aids the beekeepers to formulate their seasonal bee management schedules particularly for migration of colonies to different floral sources by identifying the floral diversity of that specified area. This can enhance the honey production and also the quality of honey. Honey obtained from Kerala represents a large array of diversified flora but scientific information about this bee flora is limited. Since such knowledge depends on local vegetation, location wise scientific knowledge on pollen and nectar sources are highly indispensable. However, the location based study conducted in Kerala state has limited information on the seasonal variation (Nair, 2007). So the present investigation is aimed to find out the bee-forage sources for *A. cerana indica* by pollen analysis of honey and pollen samples.

MATERIALS AND METHODS

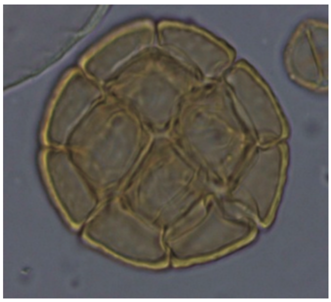
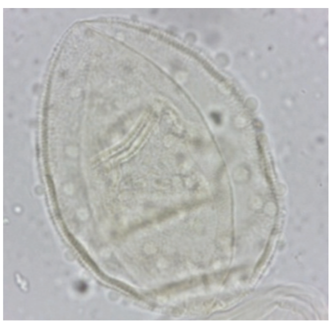
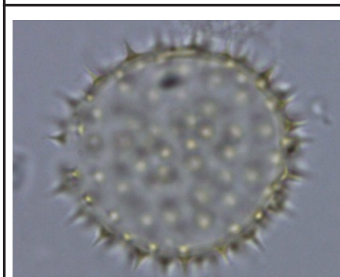
The study was conducted at AICRP on honey bees and pollinators, Department of Agricultural Entomology, College of Agriculture, Vellayani and at the Indian bee apiaries of Thiruvananthapuram and Kollam during 2011-13.

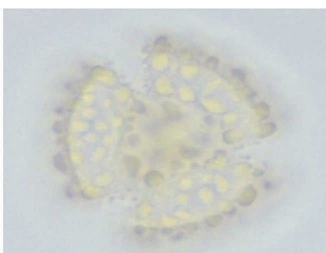
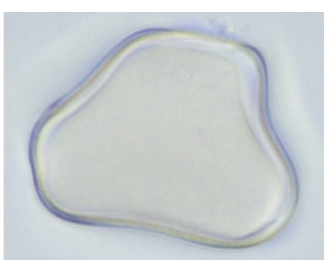
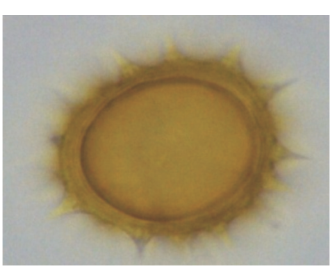
Three samples each of honey and pollen load were collected randomly from three hives of the selected apiaries during three seasons *viz*; honey flow season (January to April), dearth season (June to September) and brood rearing season (October to December) which is prevalent under Kerala conditions. The honey sample (3 ml) was collected directly from the comb cells with the aid of gradated filler to glass vials having 5 ml capacity. Pollen loads were collected from the pollen storage cells of brood chamber with the help of sterilized forceps. The collected pollen samples were fixed in 70 per cent ethyl alcohol. The samples were stored in room temperature and were subjected to pollen analysis (acetolysis and pollen slide preparation). Acetolysis was done mainly to remove the fine cellulose materials present in pollen grains thus providing better visibility for palynomorphs based on the procedures of Erdtman (1960). The pollen grains of different types obtained from each sample were identified based on the reference slides from Environmental Resource Research Centre (ERRC), Ambalamukku, Thiruvananthapuram and characters were described based on the terminology used in ‘the glossary of spore terminology’.

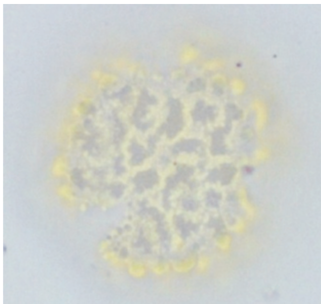
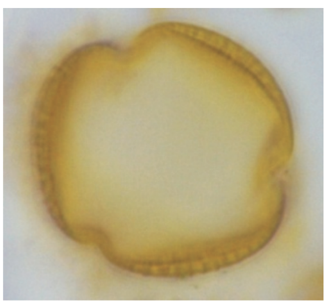
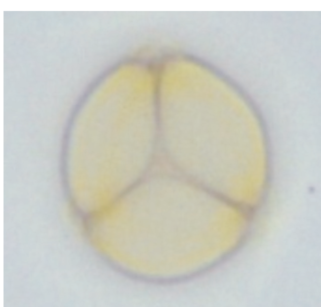
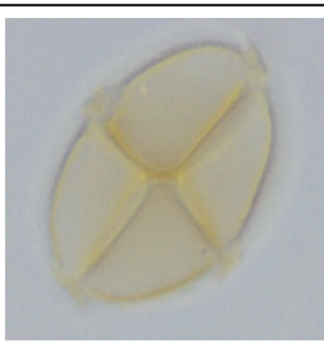
RESULTS AND DISCUSSION

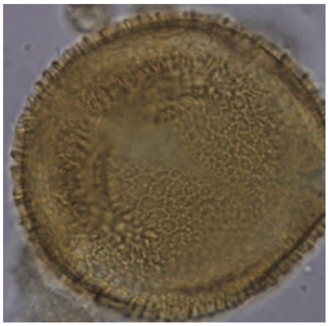
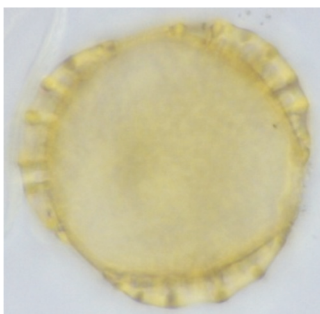
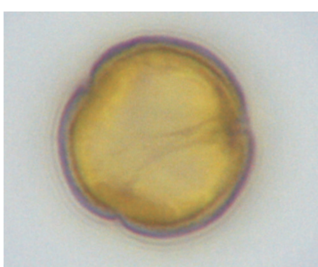
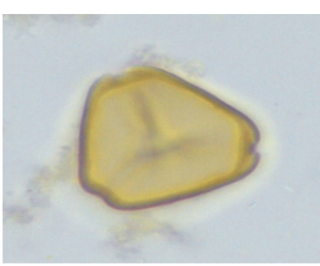
A detailed characterization of all the honey and pollen samples from fifteen locations of southern Kerala over the three seasons showed the presence of 69 different pollen types. Out of these 69 pollen types, twenty four pollen types were identified up to species level. The morphological description of the pollen types along with their microscopic view (1000 X) is given in Table 1.

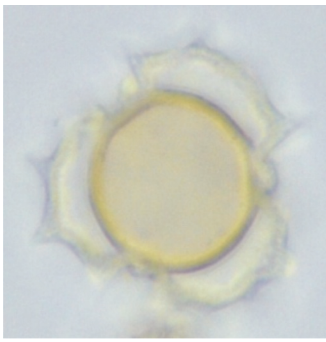
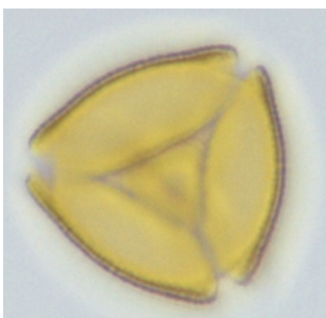
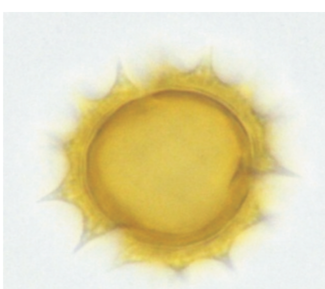
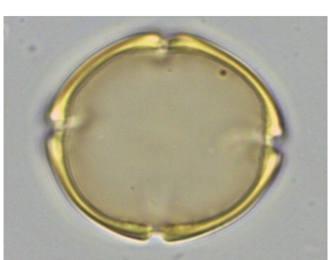
Table 1. Morphological description of individual palynomorphs

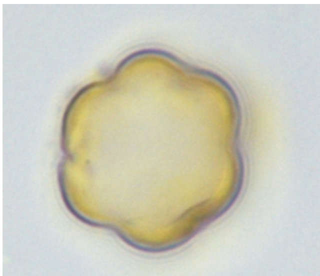
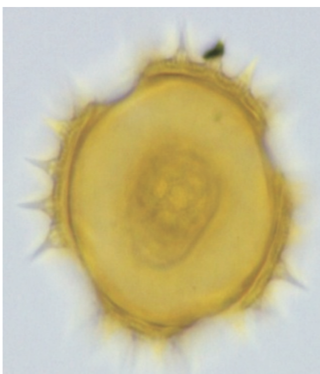
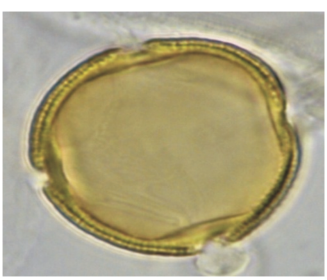
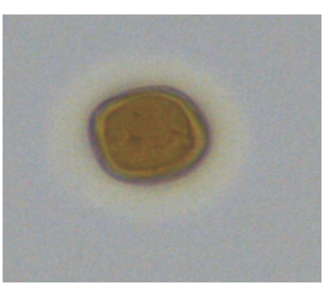
Pollen type	Pollen morphology
	*Acacia auriculiformis* A. Cunn. (Australian wattle) Family - Fabaceae Pollen grains in polyads, polyads 12-celled, spherical, polar outline circular, equatorial outline elliptic-obtuse-plane, polypantoporate, pori circular. Ektexine psilate.
	*Borassus flabellifer* L. (Palmyra palm) Family - Arecaceae Pollen grains in monads, tricolpate pollen grain. Ektexine foveolate and puntum were present in between and ektexine almost as thick as endexine.
	*Cocos nucifera* L. (Coconut) ; Family - Arecaceae Pollen grains in monads, pollen monocolpate, colpus with rounded ends. Ektexine faintly reticulate ektexine is almost as thick as endexine, endexine smooth.
	*Colocasia esculenta* L. (Taro)Family - Araceae Pollen grains in monads. Spheroidal in equatorial and polar view. Ektexine echinate, spines tapering at the tips.

Pollen type	Pollen morphology
	*Cullenia exarillata* Robyns. (Wild durian) Family - Bombacaceae Pollen grains in monads, polar outline circular and equatorial outline elliptic. Tricolporate with very short ectoaperture. Ektexine thicker than endexine with granules scattered on the surface.
	*Dillenia pentagyna* Roxb. (Dillenia) Family - Dilleniaceae Pollen grains in monads, polar outline circular and equatorial outline elliptic. Trizonocolpate, colpi narrowly elliptic, wide at equator, sides tapering and tips acute. Ektexine verrucate.
	*Elaeis guineensis* Jacq. (Oil palm) Family - Arecaceae Pollen grains in monads, polar outline triangular-obtuse-concave and equatorial outline elliptic. Trizonoporate. Psilate pollen grain.
	*Hibiscus rosasinensis* Linn. (Shoe flower) Family - Malvaceae Pollen grains in monads, polar and equatorial outline circular. Pantoporate and echinate pollen type.

Pollen type	Pollen morphology
	*Hopea ponga* dennst. (Elapongu) Family - Dipterocarpaceae Pollen grains in monads, polar outline triangular; obtuse-convex and equatorial outline elliptic. Trizonocolpate with wide colpus, sides tapering towards apocolpia to acute tips. Ektexine reticulate.
	*Mangifera indica* L. (Mango) Family - Anacardiaceae Pollen grains in monads, prolate in equatorial view. Tricolporate grain. Ektexine reticulate and thicker than endexine.
	*Mimosa pudica* L. (Sensitive plant) Family - Mimosaceae Pollen grains in tetrads, tetrads spherical, polar outline circular, equatorial outline is quadrangular-obtuse-plane, tetrapantoporate, pori circular. Ektoexine psilate.
	*Mimosa invisa* (Giant sensitive plant) Family - Mimosaceae Pollen grains in tetrads, tetrads elliptic, prolate spheroidal, exine surface tuberculated, polar outline circular and equatorial outline quadrangular-obtuse-plane. Tetrapantoporate, pori circular, psilate pollen.

Pollen type	Pollen morphology
	*Passiflora foetida* (Passion fruit) Family - Passifloraceae Pollen grains in monads, polar outline triangular-obtuse-convex and equatorial outline elliptic. Trizonocolporate. Ektexine reticulate, reticulum lumen large.
	*Peltophorum pterocarpum* (Copper pod) Family - Caesalpiniaceae Pollen grains in monads, polar outline circular and equatorial outline circular to elliptic. Ektexine reticulate. Endexine smooth. Lumina irregularly polygonal to isodiametric.
	*Poeciloneuron pauciflorum* Bedd. Family - Clusiaceae Pollen grains in monads, polar and equatorial outline circular. Tricolporate pollen. Ektexine, microreticulate, ektexine thicker than endexine.
	*Psidium guajava* L. (Guava) Family - Myrtaceae Pollen grains in monads, triangular in polar view, oblate spheroidal in equatorial view. Trizonocolporate, oralalongate. Psilate pollen.

Pollen type	Pollen morphology
	*Spilanthus calva* D. C. (Tooth ache plant) Family - Asteraceae Pollen grains in monads, polar and equatorial outlines circular. Trizonocolporate with elliptic colpi, sides abruptly tapering towards the poles. Ektexine echinate.
	*Schleichera oleosa* (Lour.) Oken. (Lac tree) Family - Sapindaceae Pollen grains in monads, polar outline triangular-acute convex to circular, equatorial outline elliptic, trizono para syncolporoidate, parasyncolpia triangular acute-concave. Ektexine reticulate.
	*Tagetes erecta* L. (Big marigold) Family - Asteraceae Pollen grains in monads, equatorial outline circular, trizonocolporate. Ektexine echinate.
	*Tabernaemontana gamblei* (Crape jasmine) Family - Apocynaceae Pollen grains in monads, tetrazonocolporate, prolate in polar view and circular in equatorial view. Ektexine thicker and bulged outward on the four sides. Psilate pollen grain and endexine smooth.

Pollen type	Pollen morphology
	*Terminalia paniculata* Roth. (Maruthu) Family - Combretaceae Pollen grains in monads, polar outline triangular-obtuse-convex and equatorial outline elliptic. Trizonocolporate with pseudocolpi in between. Ektexine psilate, ektexine almost as thick as endexine.
	*Tridax procumbens* L. (Coat buttons) Family - Asteraceae Pollen grains in monads, polar and equatorial outlines circular. Tetrazonocolporate, colpi elliptic, sides abruptly tapering towards the poles and sides tapering to acute tips. Ektoexine echinate, echinae narrowly triangular in outline.
	*Trichilia connaroides* Wight & Arm. (Peelimaram) Family - Meliaceae Pollen grains in monad, circular in equatorial view and quadrungular in polar view. Tetrazonocolporate. Ektexine granulated with ektexine thicker than endexine and bulged.
	*Muntingia calabura* L. (Bird cherry) Family - Elaeocarpaceae Pollen grains in monads, triporate pollen, pores very small in size. Ektosexine granulated. Endosexine smooth.

The pollen types were distributed among 19 families - Fabaceae, Arecaceae, Araceae, Bombacaceae, Dilleniaceae, Malvaceae, Dipterocarpaceae, Anacardiaceae, Mimosaceae, Passifloraceae, Caesalpiniaceae, Clusiaceae, Myrtaceae, Asteraceae, Sapindaceae, Apocynaceae, Combretaceae, Meliacea and Elaeocarpaceae. Of these, the pollen types from the families of Arecaceae (3) and Asteraceae (3) were best represented in honey and pollen load samples followed by the family Mimosaceae (2). The remaining families had only one type of pollen. The pollen types coming under the family Arecaceae were of *B. flabellifer*, *C. nucifera* and *E. guineensis* while that of Asteraceae were *S. calva*, *T. erecta* and *T. procumbens*. The pollen types coming under the family Mimosaceae belong to the genus *Mimosa*, *M. pudica* and *M. invisa*. This indicates the preference of honey bees to these plants for nectar and pollen sources. Similar findings were also reported by Sharma, 1969; Chaubal, 1976; Garg, 1996 and Bhargava *et al*., 2009 where they reported that most of the pollen grains in honey belong to Asteraceae.

The identified pollen types in this study included local plants such as *C. nucifera, M. pudica, M. invisa, T. erecta, A. auriculiformis* etc. Along with them, the wild plant species such as *D. pentagyna*, *H. ponga, S. oleosa*, *C. exarillata* were also recorded which may be because of the nearness of apiaries to forested areas. Though most of the apiaries are concentrated around the rubber plantations, pollen of *Hevea brasiliensis* was not present in any of the sample collected during the three seasons. This finding was in line with that of Kumar and Jagtap (2005) who reported that *H. brasiliensis* will be under represented in the samples due to the production of the nectar in the extra floral nectaries on the petioles of newly emerging leaves.

In the present study, 24 pollen types were identified up to species level which comprised of 14 trees, four shrubs and six herbs. Of these, tree species was found to be dominant which included *A. auriculiformis, B. flabellifer, C. nucifera, C. exarillata, D. pentagyna, E. guineensis, H. ponga, M. indica, P. pterocarpum, P.* pauciflorum, *S. oleosa, T. paniculata*, *T. connaroides* and *M. calabura*. This is in accordance with Mishra (1995), Sharma (2011) and Shubharani *et al.* (2012) where they reported that bees highly prefer trees rather than shrubs and herbs. Apart from this, the height of the plant is also not a barrier to bees for collecting pollen and nectar as they are found to visit both the tall trees (*C. nucifera*) and small plants (*M. pudica*). Thus the bees satisfy their dietary requirements from the preferred sources in and around the apiary irrespective of the plant height.

Thus the palynological investigations of honey and pollen load samples collected from Indian bee apiaries of southern Kerala revealed the presence of 69 pollen types, of which 24 pollen types were identified up to species level, for their colonial sustenance and honey production.

ACKNOWLEDGEMENT

The author would like to express her sincere gratitude to Dr. P. K. K. Nair, Director, ERRC, Thiruvananthapuram for his valuable suggestions and the help rendered for the pollen identification.

REFERENCES

Bhargava H. R., Jyothi J. V. A., Bhushanam M. and Surendra N. S. (2009) Pollen analysis of *Apis* honey, Karnataka, India. Apiacta 44(5):14-19.

Chaubal P. D. (1976) Palynological aspects of Compositae. Journal Palynology, 35(3):75- 81.

Erdtman G. (1960) The acetolysis method - A revised description. Sven. Bot. Tidskr. 54: 561-564.

Garg A. (1996) Palynocontents of bee collected pollen loads of autumn season in Bhimal, India. Taiwania 41 (3): 197 - 207.

Kalpana T. P. and Ramanujam C. G. K. (1997) Nectar source for honey bees in coastal district of Andhra Pradesh. Indian Bee Journal, 70(4): 261-268.

Kumar R. and Jagtap S. (2005) Melittopalynological studies on rock bee honey samples in Purandar region of Pune district in Maharashtra. Journal Palynology, 34: 157-162.

Mishra R. C. (1995) Honey bees and their management in India. Indian Council of Agricultural Research, New Delhi. P. 168

Nair M. C. (2005) Palynological identification of resources for development of apiculture in Kerala- A case study. Journal Palynology, 41 (1-2): 115-138.

Nair M. C. (2007) Pollen spectra of honeys as an index for ecospecifity in bee foraging – a case study. Journal Palynology, 43 (1-2): 89 – 110.

Ramanujam C. G. K. and Khatija F. (1991) Melittopalynology of the agricultural tracts in Guntur district, Andhra Pradesh (India). Indian Bee Journal, 52(3): 44-46.

Sharma M. (1969) Palynological studies of some bee forage plants from Sagarmal, Maharashtra, India. Indian Bee Journal, 12(2): 307-312.

Sharma M. (2011) Pollen analysis of honey from Sunderban (West Bengal). Review of Paleobotany Palynology, 89(6): 469-480.

Shubharani R., Sivaram V. and Roopa P. (2012) Assessment of Honey Plant Resources through Pollen Analysis in Coorg Honeys of Karnataka State. International Journal Plant Reproductive Biology 4(1): 31–39.

(Received 29 April 2015; accepted 19 June 2015)

ENTOMON 40 (1): 11-22 (2015)
Article No. ent. 40102

Optimization of media and temperature for antimicrobial activity of *Enterobacter* sp. associated with entomopathogenic nematode *Rhabditid* sp.

B.G. Sangeetha, C.A. Jayaprakas*, J.V. Siji and C. Mohandas

Division of Crop Protection, Central Tuber Crops Research Institute, Sreekariyam,Thiruvanathapuram 695017, Kerala, India.
E-mail: sangeethageethu214@gmail.com; prakashcaj@gmail.com

ABSTRACT: An entomopathogenic bacterium isolated from the nematode, *Rhabditis* (*Oscheius*) sp. was found to produce secondary metabolites with antimicrobial activity. The bacterium isolated from the entomopathogenic nematode was identified as *Enterobacter* sp. by using biochemical and 16S rDNA sequence analysis. Media for the production of the bioactive metabolites were standardized with six carbon sources viz. glycerol, maltose, fructose, glucose, sucrose and lactose, and four nitrogen sources viz. tryptone, yeast extract, beef extract and peptone. Antimicrobial activity was found highest for culture filtrate solvent extract (CFSE) obtained from tryptone plus glycerol (T+G) combination. Addition of peptone to the media, irrespective of carbon sources, had the least antimicrobial activity. Fermentation with tryptone plus glycerol medium when carried out at temperature ranging from 25 to 40 ºC, the highest antimicrobial activity was observed at 37 ºC.

KEYWORDS: *Rhabditis (Oscheius)* sp., antimicrobial, entomopathogenic bacteria, *Enterobacter* sp.,

INTRODUCTION

The bacteria *Xenorhabdus* and *Photorhabdus* are symbiotically associated with nematodes belonging to the families Steinernematidae and Heterorhabditidae, respectively Poinar (1990). Virulence of entomopathogenic nematodes (EPN) to insects is attributed due to its symbiotic bacteria associated with EPN Babic *et al.*, (2000). The importance of entomopathogenic bacteria (EPB) as a source of antibacterial and antifungal molecules has been studied in detail (Webster *et al*., 2002; Bode *et al*., 2009).

* Author for correspondence

Rhabditis (*Oscheius*) spp. isolated from different agroclimatic zones of Kerala resemble EPN and was found to be effective for the control of arecanut spindle bug in the field (Mohandas *et al*., 2004). These were found to kill a number of important insect pests within 24-72 h in laboratory conditions. Red ants and termites have been found to be effectively killed by the EPN in the field. They could also control mealy bugs by killing associated ant colonies (Mohandas *et al.*, 2007). Moreover the EPB associated with *R.* (*Oscheius*) sp. represent an important source of bioactive molecules with antimicrobial activity (Kumar *et al*., 2014). Media such as yeast extract broth and its modifications (Akhrust *et al.*, 1982; Sundar and Chang, 1993), Luria.Bertani broth (LB) (Sundar and Chang, 1993), sea water (Paul *et al*., 1981) and Tryptic Soya Broth (TSB) (Li *et al*., 1997; Ji *et al*., 2004) are used successfully for the production of antimicrobial metabolite from EPB. The production of antimicrobial metabolite by EPB is strongly influenced by culture medium and fermentation conditions such as pH, temperature, agitation and oxygen availability (Fang *et al*., 2010). A high degree of variation in the level of antimicrobial activity of *Bacillus* sp. associated with *Rhabditis* (*Oscheius*) sp. was reported by changing carbon and nitrogen sources in the fermentation media (Kumar *et al*., 2012). The present study was conducted to optimise different culture media for the maximization of antimicrobial activity of *Enterobacter* sp.

MATERIALS AND METHODS

Isolation and identification of Entomopathogenic bacterium: The bacterium was isolated from EPN *Rhabditis* (*Oscheius*) sp infected cadavers of *Galleria mellonella* 48-hour post infection according to the method as described by (Woodring and Kaya, 1988). The isolated bacterium was subcultured monthly and maintained in the laboratory.

Identification of the bacterium was made based on the morphological, biochemical and 16S rRNA gene sequences. Total genomic DNA of the bacteria was extracted as per the approved protocol (Reinhardt *et al*., 2008). Bacterial 16S rDNA was amplified by using bacterial universal primers: forward primer fD1 5'AGAGTTTGATCCTGGCTCAG3' and reverse primer RP2 5'CGGCTACCTTGTTACGACTT3' (Weisburg et al. 1991). The 16S rDNA gene sequences were obtained by sequencing the PCR product. The gene sequences of the bacterium obtained were aligned with Clustal alignment programme of MEGA software (Tamura *et al.,* 2011) and the nucleotide sequences were compared with those in the NCBI database using the Basic Local Alignment Search Tool (BLAST, http://www.ncbi.nlm.nih.gov/BLAST).

Fermentation media preparation: The fermentation media (g L^{-1}) were prepared with carbon source 10.0, nitrogen source 10.0, K_2HPO_4 2.0, KH_2PO_4 2.0, $MgSO_4$ 1.0, NaCl 1.0 and Na_2SO_4 1.0. Bacteria were inoculated into the liquid medium, that was prepared with different carbon sources such as glycerol, maltose, fructose, dextrose, sucrose, lactose, and nitrogen sources such as tryptone, yeast extract, beef extract, peptone, each at a level of 1% (W/V). pH of the media was adjusted to 7.0 before autoclaving. Tryptone plus glycerol medium (T+G) was fermented at different temperature regime (25, 30, 35, 37 and 40 ºC), and with L-Proline at different concentrations (25, 50, 75 and 100 mM) at varying time interval (24, 48, 72, 96 and 120 h).

Preparation of culture filtrate: The medium was taken in separate 250 mL Erlenmeyer flasks and was inoculated with a loop full of the bacterial culture. The media were incubated in a gyrorotatory shaker with 150 rpm at 30 ºC in dark for 24 h. Optical density of the culture was determined by using a spectrophotometer at 600 nm and when it reached 1.7, these cultures were transferred into 400 mL fresh sterile medium and further incubated in a gyrorotatory shaker with the same condition for 24, 48, 72, 96 and 120 h. The culture media were centrifuged at 10,000 rpm for 20 min at 4 ºC and passed through a 0.45 µM filter to obtain cell free culture filtrate.

Preparation of solvent and aqueous fraction of culture filtrate: The cell free culture filtrate, 500 mL, was neutralized with 1 N HCl and extracted with an equal volume of 500 mL ethyl acetate. The extraction was repeated twice, the culture filtrate aqueous and solvent fractions were separated by using a separating funnel. The culture filtrate solvent extract (CFSE) was concentrated using a rotary flash evaporator at 40 ºC, and the metabolite obtained was weighed, reconstituted in methanol and used for assay of antimicrobial activity.

Antimicrobial assay: Antibacterial and antifungal activity of the CFSE were studied against agriculturally important fungi and medically important bacteria and fungi, by the agar well diffusion assay as described in Clinical and Laboratory Standards Institute (CLSI), 2008. Test pathogens which includes Gram positive bacteria, *Bacillus subtilis,* MTCC 2756*; Staphylococcus aureus,* MTCC 902, and Gram negative bacteria *Escherichia coli,* MTCC 2622, and *Pseudomonas aeruginosa,* MTCC 264 were procured from the Microbial Type Culture Collection (MTCC), Institute of Microbial Technology (IMTECH), Chandigarh. Commercial antibiotics ceftazidime 30 $\mu g.mL^{-1}$ and ciprofloxacin 5 $\mu g.mL^{-1}$ were used as positive reference standard. Agriculturally important fungi like *Fusarium oxysporum,* MTCC 284, *Rhizoctonia solani,* MTCC 4634, *Penicillium expansum,* MTCC 2006, and medically important fungi *Aspergillus flavus,* MTCC 183, *Candida albicans,* MTCC 277 were also obtained from IMTECH. Amphotericin was used as control for *C. albicans,* whereas Carbendazin 100 $\mu g.mL^{-1}$ was used for the remaining four fungi. Methanol was kept as control along with the test samples for antibacterial and antifungal activity. Diameter of the inhibition zones was measured.

Statistical analysis: Data were analysed using SPSS (Version 17.0; SPSS, Inc., Chicago, IL, USA). Means of the samples were compared using univariate ANOVA with zone of inhibition as dependent variable. Statistical significance was defined as $p< 0.05$.

RESULTS AND DISCUSSION

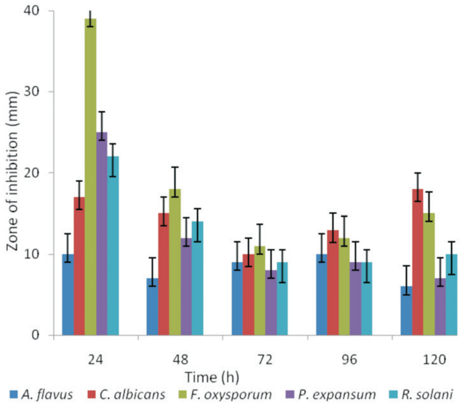
Identification of Entomopathogenic bacterium (EPB): Colonies of bacteria observed were irregular with undulate margins, devoid of pigmentation and measured 2.6 to 0.69 µm. It was Gram negative, rod shaped and motile. Carbohydrate fermentation test revealed that the bacterium could utilize glycerol, maltose, glucose, fructose, mannitol, sucrose, starch as carbon source. The gene sequencing confirmed the bactierium as *Enterobacter* sp. and the sequence was deposited in the NCBI Gen Bank with the accession number JX470959.

Antimicrobial activity of extract: Antimicrobial activity of the CFSE obtained from T+G was significantly higher followed by tryptone plus maltose (T+M) at 30 ºC for 24 h (Fig. 1-2), and the highest antifungal activity was observed against *Fusarium oxysporum.* In both cases the zone of inhibition for CFSE from the medium with T+G was, 39.00$\pm$1.00, 25.33$\pm$1.52, mm respectively against *F. oxysporum* and *P. expansum*. The CFSE obtained from yeast extract plus glycerol and yeast extract plus maltose media also recorded highest antimycotic activity against *F. oxysporum* and *P. expansum* (Fig. 3-4). The antibacterial activity was recorded highest in the CFSE obtained from T+G and T+M against *E. coli* and *B. subtilis* respectively (Fig. 6-7). Antimicrobial activity of CFSE obtained from medium with peptone as nitrogen source (irrespective of its carbon sources) was insignificant against the test organisms (Table 1 and 2).

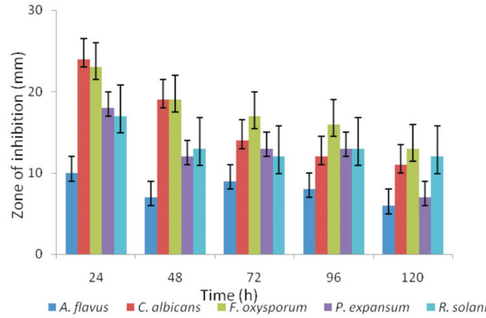
Influence of temperature and L-Proline on antimicrobial activity: The effect of temperature on the antimicrobial activity of CFSE obtained from (T+G) medium at 25, 30, 35, 37 and 40 ºC revealed that the maximum antimycotic activity was at 37 ºC (Table 3). A high degree of variation in the level of antimicrobial activity against the test microbes were observed when L-Proline was added in the media at different concentrations. Of the different concentrations of L-Proline added, the highest antimicrobial activity was observed at 75 mM (Fig. 5).

The present study was conducted with the aim to optimise media and temperature to get maximum antimicrobial activity of *Enterobacter* sp. associated with EPN *Rhabditis (Oscheius)* sp. *Enterobacter* sp. are very common in insects and normally found in soil and water (Bucher 1981). Previous studies also reported isolation of three insect pathogenic bacteria *Enterobacter aerogenes*, *E. agglomerans* and *E. cancerogenus* against larvae of *Oberea linearis* (Bahar and Demirbag 2007). The insecticidal activity of *Enterobacter* sp., *E. aerogenes* against larvae of *Melolontha melolontha* and *Agrotis segetum* with 20, 60 % mortality was reported by (Sezen *et al.*, 2007; Sevim *et al.*, 2010).

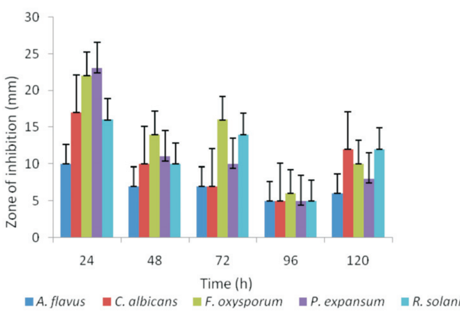
Among the different carbon sources tested, glycerol proved to be the best for antimicrobial activity and that was followed by maltose, fructose and glucose. Variations in the fermentation conditions often result in an alteration in antibiotic production. The carbon source needed for maximal yield of the antibiotic production also seems to be different among bacterial strains. The choice of carbon sources greatly influenced secondary metabolism and antibiotic production (El-Banna 2006; Martin and Demain 1978). Glycerol is known to be an important medium component for the production of antifungal metabolites from microorganisms Fukuda *et al.,* (2005). It was also reported that maltose and glycerol had the strongest effect on the antibiotic activity of *Xenorhabdus* sp. D43 Yang *et al.*, (2006). In the current investigation tryptone was identified as the best nitrogen source for antimicrobial activity, but it was significantly less when peptone was replaced as nitrogen source. This indicates that the source of nitrogen has a pivotal role in the production of antimicrobial activity. Carbon and nitrogen sources are the important nutritional components of the medium to influence the antibiotic activity of *X. nematophila* (Yang *et al*., 2001; Wang *et al*., 2008). The *Enterobacter* sp. showed maximum antimicrobial activity at 24 h followed by 48 and 72 h which is followed



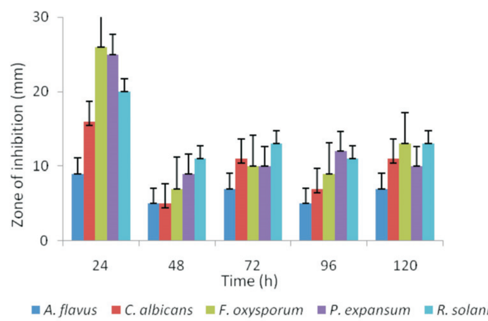
1. Tryptone plus glycerol



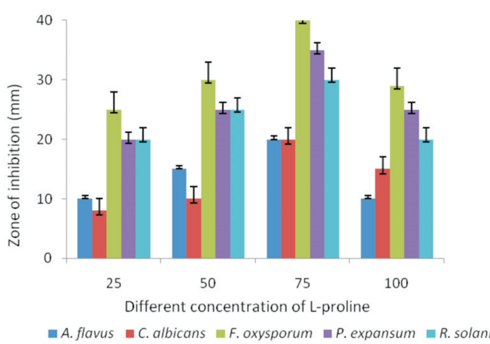
2. Tryptone plus maltose



3. Yeast extract plus glycerol

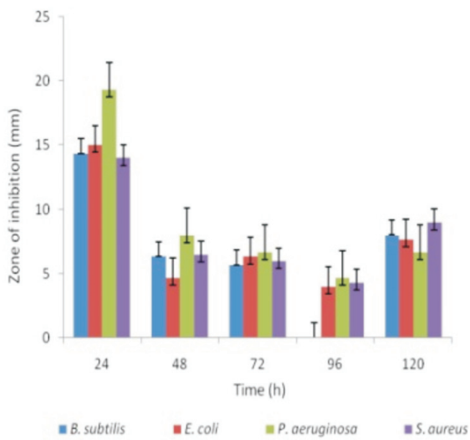


4. Yeast extract plus maltose

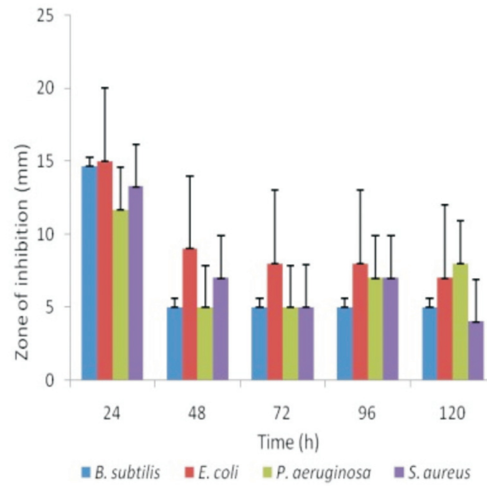


5. Tryptone plus glycerol with L-Proline

Figs (1 – 5) Antifungal activity of culture filtrate solvent extract of *Enterobacter* sp. obtained from different media



6. Tryptone plus glycerol



7. Tryptone plus maltose

Figs (6-7) Antibacterial activity of culture filtrate solvent extract of *Enterobacter* sp. with different media

by a stationary phase. The antimicrobial metabolite production was detected even after 72 h in the late exponential and stationary phase upto 120 h which may be due to the influence of different carbon sources on secondary metabolite production. Different carbon sources, like dextrose (Rizk and Metwally 2007), lactose (Petersen *et al.,* 1994), sucrose (Charkrabarti and Chandra 1982), fructose (James and Edwards 1988) and starch (Kotake *et al*., 1992) have been reported to be suitable for production of secondary metabolites in different microorganisms. It was also reported that glucose, usually an excellent carbon source for growth, interferes with the biosynthesis of many antibiotics such as bacitracin (Haavik, 1974) and actinomycin (Gallo and Katz, 1972). During studies on fermentation medium development, polysaccharides or oligosaccharides are often found to be better than glucose as carbon sources for antibiotic production (Martin and Demain, 1980). Duration of fermentation and temperature also affected the biological activity of the metabolites extracted from EPB. Maximum antimicrobial activity was obtained when the bacterial fermentation was carried out for 24 h at 37 ºC. Earlier studies on *Bacillus* sp. associated with *Rhabditis* (*Oscheius*) sp. also showed that antibiotic activity was strongly influenced by growth medium, temperature and duration of fermentation time Siji *et al*.(2013).

Addition of $MgSO_4$, $MgCl_2$, NaCl, KH_2PO_4, KNO_3, $(NH_4)_2SO_4$ favoured the production of antibiotic activity in *Xenorhabdus* sp. D43 whereas $Zn(NO_3)_2$ and $CuSO_4$ had a negative impact Wang *et al*., (2011). This revealed that trace elements in the media also play an important

Table 1. Comparative influence of peptone with different carbon sources on antifungal activity of culture filtrate solvent extract of *Enterobacter* sp.

Fungi	Time (h)	Zone of inhibition in (mm) for each combination*				Control	
		Peptone - glycerol	Peptone- maltose	Peptone - fructose	Peptone - glucose	Carbend- azin	Amphote- ricin
A. flavus	24	8	8	7	5	25	-
	48	7	6	7	5	24	-
	72	7	6	6	5	25	-
	96	0	6	9	0	25	-
	120	5	0	0	0	24	-
C. albicans	24	10	10	11	5	-	23
	48	10	9	6	5	-	22
	72	9	9	6	5	-	23
	96	0	8	6	0	-	21
	120	7	0	0	0	-	23
F.oxysporum	24	14	14	0	10	16	-
	48	10	12	6	9	15	-
	72	15	9	6	9	16	-
	96	10	15	5	0	15	-
	120	10	0	0	9	16	-
P. expansum	24	20	11	6	10	24	-
	48	10	10	6	10	22	-
	72	11	8	9	8	23	-
	96	0	10	9	8	24	-
	120	7	0	6	0	24	-
R. solani	24	14	12	7	10	19	-
	48	11	11	10	7	18	-
	72	12	11	10	10	19	-
	96	0	10	10	0	18	-
	120	8	0	0	0	19	-

*Values represent mean of three replications, - not tested (pd”0.05)

Table 2. Comparative influence of peptone with different carbon sources on antibacterial activity of culture filtrate solvent extract of *Enterobacter* sp.

Bacteria	Time (h)	Zone of inhibition in mm for each combination*					
		Peptone - glycerol	Peptone-maltose	Peptone - fructose	Peptone - glucose	Peptone - sucrose	Ciproflo-xacin
B. subtilis	24	12	10	3	5	4	31
	48	11	8	7	5	0	31
	72	5	7	8	5	0	31
	96	5	5	5	9	0	31
	120	0	4	0	0	0	31
E. coli	24	7	12	11	0	6	28
	48	6	9	9	3	0	28
	72	5	6	8	5	0	28
	96	5	5	5	7	0	28
	120	0	0	4	0	0	28
P. aeruginosa	24	13	11	4	4	5	25
	48	12	7	5	4	0	25
	72	14	7	5	5	0	25
	96	6	5	5	6	0	25
	120	0	6	0	0	0	25
S. aureus	24	8	8	11	5	7	31
	48	7	9	10	5	0	31
	72	7	6	8	5	0	31
	96	5	5	4	7	0	31
	120	0	0	4	4	0	31

* Values represent mean of three replications, (pd”0.05)

role in antimicrobial activity. Concentration of free amino acid proline in the hemolymph of *G. mellonella* plays an important role in the virulence and antibiotic activity of the EPB (Waterfield, 2004). In this investigation also variation in antibiotic activity was observed when the media were supplemented with different concentrations of L-Proline. The study confirmed that media with optimal levels of carbon, nitrogen sources, trace elements and amino acids play an important role in antimicrobial activity of EPB associated with the *Rhabditis (Oscheius)* sp.

Table 3. Antifungal activity of culture filtrate solvent extract of *Enterobacter* sp. at different temperature

Fungi	Zone of inhibition (mm)*											
	25 °C		30 °C		35 °C		37 °C		40 °		Carbe-ndazin	Ampho-tericin
A. flavus	.	20	5	15	5	18	7	18	.	18	25	.
C. albicans	5	20	10	22	10	23	11	33	.	26	.	23
F. oxysporum	5	30	11	35	11	37	12	45	5	38	16	.
P. expansum	.	25	12	25	12	26	13	30	8	25	24	.
R. solani	.	25	11	25	11	26	13	30	9	26	19	.

* Values represent mean of three replications, - not tested (pd”0.05)

ACKNOWLEDGEMENT

The first author is grateful to Council of Scientific and Industrial Research, Government of India for funding. The authors thank the Director, CTCRI, for providing facilities for the work.

REFERENCES

Akhurst R. J. (1982) Antibiotic activity of *Xenorhabdus* spp., bacteria symbiotically associated with insect pathogenic nematodes of the families Heterorhabditidae and Steinernematidae. Journal of General Microbiology, 128: 3061-3065. http://dx.doi.org/10.1099/00221287-128-12-3061

Babic I., Saux M. F., le.Giraud E. and Boemare N. (2000) Occurrence of natural dixenic associations between the symbiont *Photorhabdus luminescens* and bacteria related to *Ochrobactrum* spp. in tropical entomopathogenic Heterorhabditis spp. (Nematoda, Rhabditida). Microbiology, 146: 709-718.

Bahar A.A and Demirbað Z. (2007) Isolation of pathogenic bacteria from *Oberea linearis* (Coleptera: Cerambycidae). Biologia, 62: 13-18.

Bode H. B. (2009) Entomopathogenic bacteria as a source of secondary metabolites. Current Opinion in Chemical Biology, 13: 224-230. http://dx.doi.org/10.1016/j.cbpa.2009.02.037

Bucher G. E. (1981) Identification of bacteria found in insects. In. Burges HD ed. Microbial control of pest and plant diseases. London Academic Press, pp 10-30.

Charkrabarti S. and Chandra A.L. (1982) A new streptomycete and a new polyene antibiotic acmycin. Folia Microbiologica, 27: 169-172.

CLSI, Clinical and laboratory Standards Institute. 2008. Reference methods for broth dilution antifungal susceptibility tests of yeasts. CLSI documents M27.S3. 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087.1898 USA.

El-Banna N.M. (2006) Effect of carbon source on the antimicrobial activity of *orynebacterium kutscheri* and *C. xerosis*. African Journal of Biotechnology, 5: 833-835.

Fang X. L., Feng J. T., Zhang W. G., Wang Y. H. and Zhang X. (2010) Optimization of growth medium and fermentation conditions for improved antibiotic activity of *Xenorhabdus nematophila* TB using a statistical approach. African Journal of Biotechnology, 9: 8068-8077. http://dx.doi.org/10. 5897/AJB09.1939

Fukuda T., Matsumoto A., Takahashi Y., Tomoda H. and Amura S. (2005). Phenatic acids A and B, new Potentiators of antifungal miconazole activity produced by *Streptomyces* sp. K03-0132. Journal of Antibiotic, 58: 252–259.

Gallo M. and Katz E. (1972) Regulation of Secondary Metabolite Biosynthesis: Catabolite Repression of Phenoxazinone Synthase and Actinomycin Formation by Glucose. Journal of Bacteriology 109: 659–667.

Haavik H. (1974). Studies on the formation of bacitracin in *Bacillus licheniformis*: effect of glucose. Journal of General Microbiology, 81: 383- 390.

James P.D.A and Edwards C. (1988) The effect of cultural conditions on growth and secondary metabolism in *Streptomyces thermoviolaceous* grown on chemostat. FEMS Microbiology Letters, 52: 1-6.

Ji D., Yi Y., Kang G., Choi Y., Kim P., Baek N. I. and Kim Y. (2004) Identification of antibacterial compound, benzylideneacetone, from *Xenorhabdus nematophila* against major plant pathogenic bacteria. FEMS Microbiology Letters 239: 241-248. http://dx.doi.org/10.1016/j.femsle.2004.08.041

Kotake C., Yamasaki T., Moriyama T., Shinoda M., Komiyama N. and Oki T. (1992) Butyrolactols A & B, new antifungal antibiotics. Taxonomy, isolation, physico-chemical properties, structure and biological activities. Journal of Antibiotics, 45: 1442- 1450.

Kumar S. N., Siji J. V., Ramya R. Bala Nambisan. and Mohandas C. (2012) Improvement of antimicrobial activity of compounds produced by *Bacillus* sp. associated with a *Rhabditid* sp. (Entomopathogenic Nematode) by changing carbon and nitrogen sources in fermentation media. Journal of Microbiology Biotechnology and Food Sciences, 1: 1424-1438.

Kumar S.N., Mohandas C., Nambisan B., Sreerag R.S and Jayaprakas C.A. (2014) Cyclo(l-Pro-d-Arg): a new antibacterial and antitumour diketopiperazine from *Bacillus cereus* associated with a rhabditid entomopathogenic. Folia Microbiologica, 59: 197-202. http://dx.doi: 10.1007/s12223-013-0282-2.

Li J. X., Chen G. H. and Webster J. M. (1997) Nematophin, a novel antimicrobial substance produced by *Xenorhabdus nematophilus* (Enterobactereaceae). Canadian Journal of Microbiology, 43: 770-773. http://dx.doi.org/10.1139/m97-110

Martin J. F. and Demain A. L. (1978) Fungal development and metabolite formation. In: The Filamentous Fungi. Eds. Smith JE, Berry DR, Arnold, London.3: 426-450.

Martin, 1. F. and Demain, A. L. (1980). Control of antibiotic synthesis Microbiological Reviews, 44: 230-251.

Mohandas C., Sheela M. S., Sheeba M. and Naveen Raj D.S. (2004) *Rhabditis (Oscheius)* spp. (Nematoda: Rhabditidae) a new pathogenic nematode of crop pests. National Sympo. Green pesticides for insect pest management. Feb. 5-6, 2004, Abstract. 51- 52.

Mohandas C., Sheeba M., Firoza A.J. and Rajamma P. (2007) Bacteria associated with *Rhabditis*(*Oscheius*) spp. (Rhabditidae: Nematoda) for the biocontrol of insect pests. Proceedings- National Seminar on Achievements and Opportunities in Post harvest Management and value Addition in Root and Tuber Crops (NSRTC –2). P. 195–198.

Paul V. J. Frautschy S. Fenical W. and Nealson K.H. (1981) Antibiotics in microbial ecology. Isolation and structure assignment of several new antibacterial compounds from the insect-symbiotic bacteria *Xenorhabdus* spp. Journal Chemical Ecology, 7: 589- 597. http://dx.doi.org/10.1007/BF00987707

Petersen F., Moerker T., Vanzanella F. and Peter H.H. (1994) Production of cladospirone bisepoxide, a new fungal metabolite. Journal of Antibiotics, 47:1098-1103

Poinar G. (1990) Biology and taxonomy of Steinermatidae and Heterorhabditidae, In R. Gaugler, & H. K. Kaya (Eds.) Entomopathogenic nematodes in biological control, pp.23-60.

Reinhardt E. L., Ramos P., L. Gilson P., Manfio G. P., Barbosa H. R., Pavan C. and Moreira-Filho C. A. (2008). Molecular characterization of nitrogen-fixing bacteria isolated from brazilian agricultural plants at são paulo state. Brazilian Journal of Microbiology, 39: 414-422. http://dx.doi.org/10.1590/S1517-83822008000300002

Rizk MT, Metwally H. (2007) Factors affecting growth and antifungal activity of some *Streptomyces* species against *Candida albicans*. Journal of Food Agriculture and Environment, 5: 446-449.

Sevim A., Demirbað Z.and Demir I. (2010) A new study on the bacteria of *Agrotis segetum* Schiff. (Lepidoptera: Noctuidae) and their insecticidal activities. Turkish Journal of Agriculture and Forestry, 34: 333-342. http://dx.doi.org/10.3906/tar-0902-9

Sezen K., Demir Ý. And Demirbað Z.(2007) Identification and pathogenicity of entomopathogenic bacteria from common cockchafer, Melolontha melolontha (Coleoptera : Scarabaeidae). New Zealand Journal of Crop and Horticultural Science, 35:1, 79-85. http://dx.doi.org/10.1080/01140670709510171

Sundar L. and Chang F. N. (1993) Antimicrobial activity and biosynthesis of indole antibiotics produced by *Xenorhabdus nematophilus*. Journal of General Microbiology, 139: 3139-3148.

Tamura K., Peterson D., Peterson N., Stecher G., Nei, M. and Kumar S. (2011) MEGA5:Molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. Molecular Biology and Evolution, 28: 2731-2739. http://dx.doi.org/10.1093/molbev/msr121

Vijayakumari S. J. Kumar S. N. Nambisan B. and Mohandas C. (2013) Optimization of mediaand temperature for enhanced antimicrobial production by bacteria associated with *Rhabditis* sp. Iranian Journal of Microbiology, 5: 136-141.

(Received 23 February 2015; accepted 19 June 2015)

ENTOMON 40 (1): 23-62 (2015)
Article No. ent. 40104

Agriculturally important Pyraloidea (Lepidoptera) of India: key to subfamilies, current taxonomic status and a preliminary checklist

M. Shankara Murthy*, S. K. Nagaraj and A. Prabhuraj[1]

Department of Entomology, College of Agriculture, University of Agricultural Sciences, Bheemarayanagudi 585 287, Karnataka, India. E-mail:smurthyent@gmail.com
[1]Department of Entomology, University of Agricultural Sciences, Raichur 584 104, Karnataka, India

ABSTRACT: Key to subfamilies, synoptic classification and a preliminary checklist of agriculturally important Pyraloidea in India are provided.

Key words: Pyraloidea, Lepidoptera, key to subfamilies, current taxonomic status

INTRODUCTION

Pyraloidea is the third largest Super-family of Lepidoptera after Noctuoidea and Geometroidea. This group includes about 16,000 described species worldwide, with greatest richness in the tropics (Solis *et al.*, 2007 and Regier *et al.,* 2012). In India, Mathew (2006) reported 1646 species of Pyraloidea in his check list of Indian pyralids, of which 1369 species were documented in the Fauna of British India by Hampson (1896).

Pyraloids are ditrysian moths. The fundamental features that define the pyraloids are a basally scaled proboscis, well developed maxillary palpi, veins R_3 and R_4 of the forewing stalked or fused and paired tympanal chambers on second abdominal sternite, each with a tympanum and a conjunctiva (Plate1). Taxonomy of Pyraloidea has undergone a sea change in the last three decades. Initially, Linnaeus (1758) recognized Pyraloidea as a sub genus of *Pyralis*, in his comprehensive moth genus *Phaleana*. He also included a number of Pyraloidea species into subgenus *Geometra* and members of narrow winged insect sub-families such as Crambinae and Phycitinae in the sub genus *Tinea.* Later, Latreille (1809) elevated the family Pyralidae into superfamily Pyraloidea. Börner (1925) was the first to recognize the difference between the two groups in the Pyraloidea *i.e.,* Pyralidae and Crambidae on the basis of tympanum and presence or absence of praecinctorium. Later, Munroe (1972) proposed Pyraliformes,

* Author for correspondence

Crambiformes and Midiliformes based on the differences between tympanum. Minet (1983) subsequently elevated Munroe's groups to the Pyralidae and Crambidae based on an extensive study of tympanal organs in Lepidoptera. Munroe and Solis (1999) highlighted the history of classification of Pyraloidea. The familial composition of the Pyraloidea has changed markedly over the past thirty years, with a general decrease in the number of families. The families such as Pterophoridae, Alucitidae, Thyrididae, Hyblaeidae, Oxychirotidae and Tineodidae formerly included in Pyraloidea, are now in their own super families with unresolved affinities (Solis, 2007). In recent years, most of the specialists have agreed that the difference in the structure of tympanum in adults and few larval characters justify division of the former or old Pyralidae family into two families, Crambidae and Pyralidae. However, it is very difficult to recognize crambids and pyralids as distinct groups on the basis of external appearance owing to the enormous variability within each group. Hence an easy diagnostic key to subfamilies of Pyraloidea occurring in India is provided. A synoptic classification and a preliminary checklist of species associated with agricultural crops in India, incorporating recent nomenclatural changes, are also presented here.

MATERIALS AND METHODS

Dissecting techniques and descriptive terminology of male genitalia follow Clark (1941) and Kirti and Gill (2005) with appropriate modifications. Before dissection of genitalia, adults were photographed. The wing slides were prepared by following Robinson (1976) and Thomas (2007) with slight modification. The characters were observed under stereoscopic binocular microscope and photographed using Trinocular streozoom microscope with auto-montage (Lieca 205 model).

The synopsis is a skeletal classification of agriculturally important Pyraloidea in India. This provides a summary of the subfamilies, genera and species occurring in the Indian region and gives the current state of knowledge incorporating the results of modern taxonomic work. The families, sub-families and species of Pyraloidea are listed alphabetically. Further, the valid name, type genus, type species, type locality and synonyms are also presented.

The preliminary checklist of Pyraloidea associated with agricultural crops in India is based on the Global Information System on Pyraloidea (http://www.pyraloidea.org) as well as textbooks such as Lefroy (1906), Fletcher (1914), Ayyar (1940), Pradhan (1969), Nair (1971), Butani and Jotwani (1984), Regupathy *et al*. (1997), Reddy *et al*. (2001), Atwal and Dhaliwal (2005), Reddy (2010), David and Ramamurthy (2012) and David and Ananthakrishan (2014).

RESULTS AND DISCUSSION

Key to subfamilies of Pyraloidea

1. Tympanal case is almost closed, the conjunctiva and tympanum are in the same plane, and praecinctorium is absent. Male genitalia with lateral arms arising at base of uncus

and fore wing vein R_5 stalked or fused with R_{3+4} (Plate 2A) (**Pyralidae**) ………………………………………………………………………………………2

- Tympanal case is open with a wide antero-medial aperture, the conjunctiva and tympanum are in different plane and meet at a distinct angle, and praecinctorium is present. Male genitalia with lateral arms not arising at base of uncus and forewing vein R5 is free (Plate 2B) (**Crambidae**) …………………………………………………4

2(1). Hind wing with median nervure pectinated on upper side (Plate 3a) ………………………………………………………………………………………3

- Hind wing with median nervure not pectinated on upper side (Plate 3b) ……………………………………………………………………………**Epipaschiinae**

3(2). Proboscis and ocelli are absent; vein R_5 in forewing present; frenulum spines more than one in female; male genitalia with uncus broad and rounded (Plate 3c, d, e, i & k) ……………………………………………………………………………**Galleriinae**

- Proboscis usually well developed, sometimes rudimentary or absent; ocelli present; vein R_5 in forewing absent; frenulum spines single in both sexes; male genitalia with uncus simple and rounded (Plate 3f, g, h, j & l)…………………………………**Phycitinae**

4(1). Chaetosema present (Plate 4a) ……………………………………………………5

- Chaetosema absent (Plate 4b) ……………………………………………………7

5(4). Hindwing with cubital vein not pectinated on upperside; male genitalia with lateral sub-teguminal process (Plate 4c & d) ……………………………………………6

- Hindwing with cubital vein pectinated on upperside; male genitalia without lateral sub-teguminal process (Plate 4e & f) ………………………………………**Crambinae**

6(5). In forewing, R_2 is more often separated from R_{3+4}; vein Cu_2 is present and confined to terminal part (Plate 4g) ……………………………………………**Schoenobiinae**

- In forewing, R_2 is stalked with R_{3+4} and vein Cu_2 is absent (Plate 4h) ……………………………………………………………………………**Acentropinae**

7(4). Valve of male genitalia without costal process (Plate 4i) ………………………………………………………………………………………8

- Valve of male genitalia with costal process (Plate 4j) ……………………**Cybalomiinae**

8(7). Praecinctorium is dorsally bilobed (Plate 4k) ……..............…….…………..**Spilomelinae**

- Praecinctorium is simple (Plate 4l) ………......……………….…………....….**Glaphyriinae**

Synoptic classification of agriculturally important Pyraloidea in India

Superfamily PYRALOIDEA

Family PYRALIDAE

Subfamily EPIPASCHIINAE Meyrick, 1884; type genus: *Epipaschia* Clemens, 1860

= Pococerinae Hampson, 1918; type genus: *Pococera* Zeller, 1848

Genus: *LEPIDOGMA* Meyrick, 1890; type species: *Hypotia tamaricalis* Mann, 1873

= *Asopina* Christoph, 1893; type species: *Asopia obatralis* Christoph, 1877

= *Precopia* Ragonot, 1891; type species: *Hypotia atomalis* Christoph, 1887

Genus: *LAMIDA* Walker, 1859; type species: *Lamida moncusalis* Walker, 1859

= *Allata* Walker, 1863; type species: *Allata penicillata* Walker, 1862

***Lamida moncusalis* Walker (1859)**

= *penicillata* Walker (1859)

Genus: *ORTHAGA* Walker, 1859; type species: *Orthaga euadrusalis* Walker, 1859

= *Edeta* Walker, 1859; type species: *Edeta icarusalis* Walker, (1858)

= *Hyperbalanotis* Warren, 1891; type species: *Glossina achatina* Butler, 1878

= *Pannucha* Moore, 1888; type species: *Pannucha aenescens* Moore, 1888,

= *Proboscidophora* Warren, 1891; type species: *Pyralis tritonalis* Walker, 1859

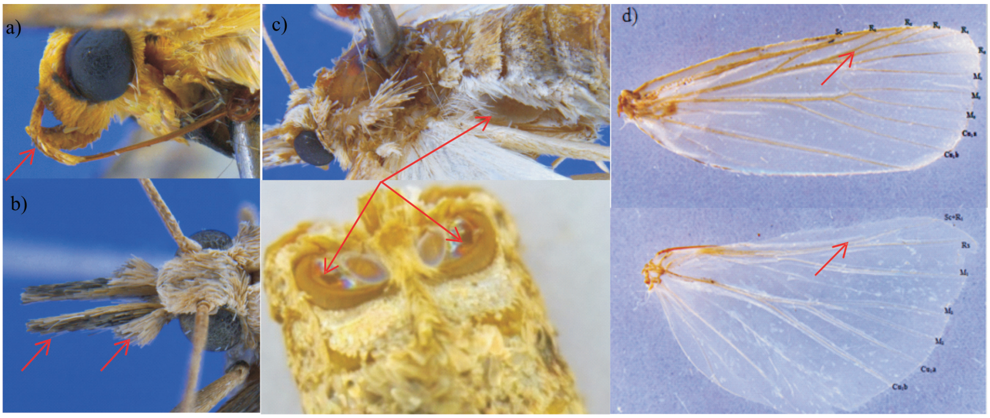
***Orthaga eumictalis* Hampson**; type locality: New Guinea, Fak-fak

***Orthaga euadrusalis* Wlk.**

= *Orthaga acontialis* Walker, 1863

***Orthaga exvinacea* Hmps;** type locality: India, Nilgiri

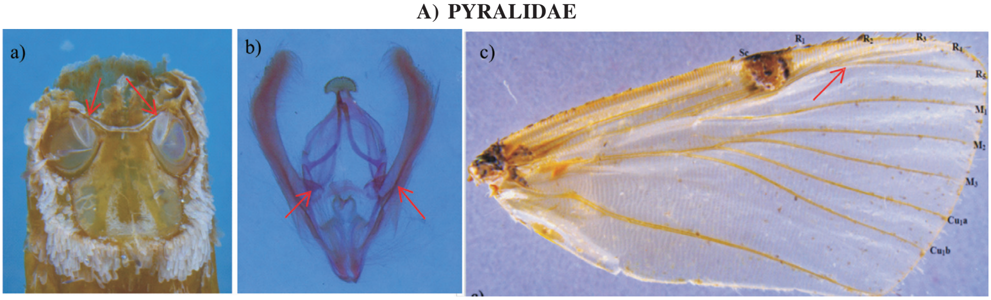
= *Balanotis exvinacea* Hampson, 1891



a) Basally scaled proboscis b) Well developed labial and mxillary palpi c) Paired tympanal chambers on sternite 2, each with a tympanum and a conjunctiva d) Veins R3 and R4 of the fore wing stalked or fused and SC+R1 and RS of hind wing anastomated at distad end

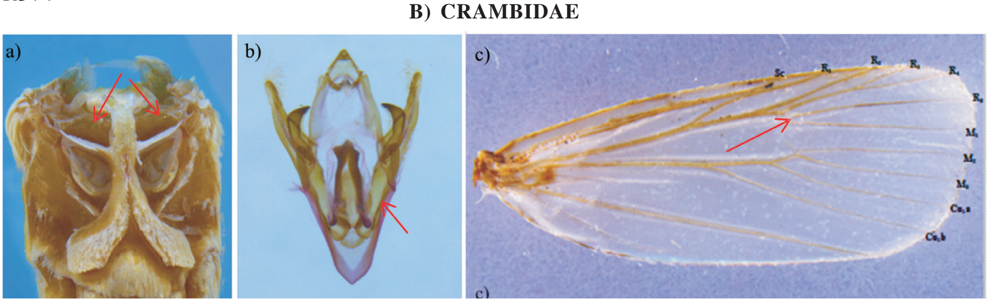
Plate 1: Diagnostic characters of Superfamily Pyraloidea

A) PYRALIDAE



a) Tympanal case almost closed, the conjunctiva and tympanum are in the same plane and praecinctorium is absent; b) male genitalia with lateral arms at base of uncus; c) fore wing veins R5 stalked or fused with R3+4

B) CRAMBIDAE



a) Tympanal case open with a wide antero-medial aperture, the conjunctiva and tympanum are in a different plane and praecinctorium is present ; b) male genitalia without lateral arms at base of uncus; c) forewing veins R5 is free

Plate 2 A & B : Diagnostic characteristic features of families of Pyraloidea

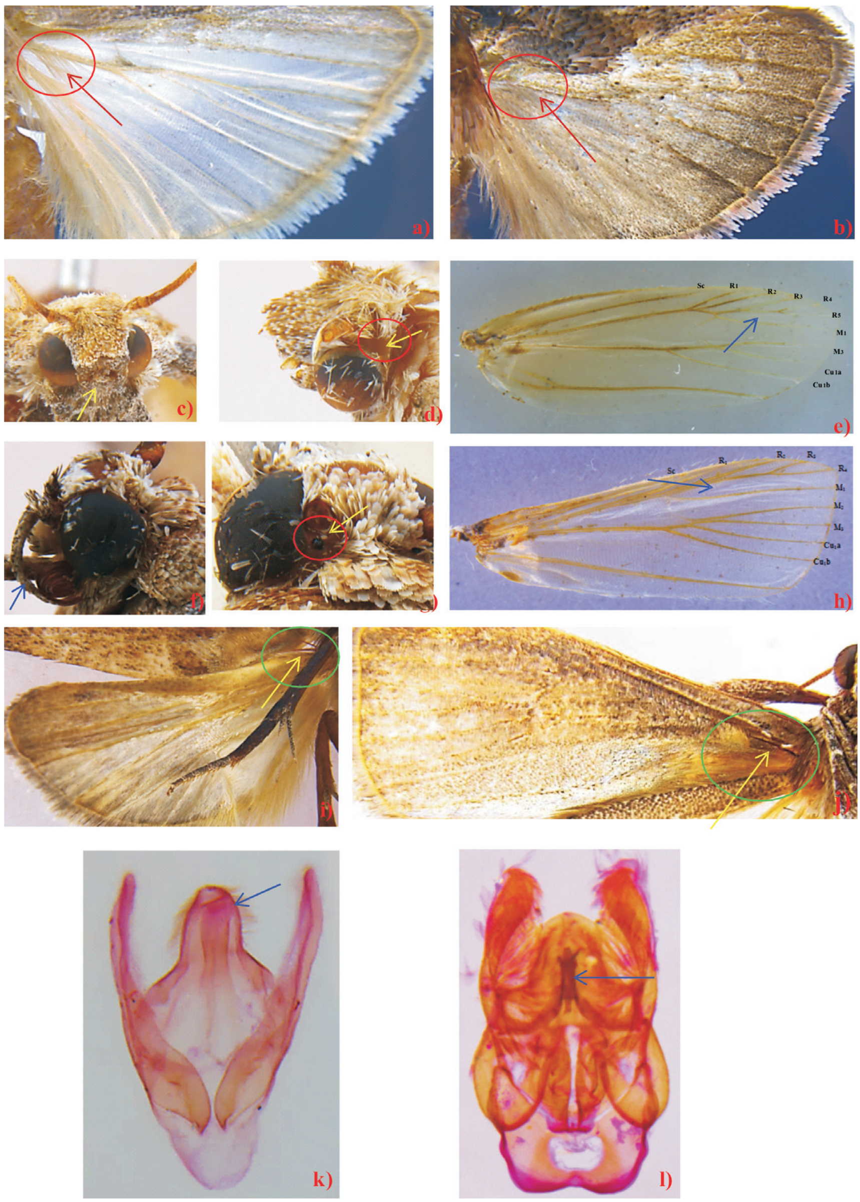


Plate 3. Morphological and genital characters of subfamilies of Pyralidae

a) Hind wing with median nervure pectinated on upper side. b) Hind wing with median nervure not pectinated on upper side. c) Proboscis absent. d) Ocelli are absent e) Vein R_5 in forewing present f) Proboscis usually well developed. g) Ocelli present h) Vein R_5 in forewing absent i) Frenulum spines more than one in female. j) Frenulum spines single in both sexes. k) Male genitalia with uncus broad and rounded. l) Male genitalia with uncus simple and rounded.

Plate 4. Morphological and genital characters of subfamilies of Crambidae

a) Chaetosema present. b) Chaetosema absent. c) Hindwing with cubital vein not pectinated on upperside. d) Male genitalia with lateral sub-teguminal process. e) Hindwing with cubital vein pectinated on upperside. f) Male genitalia without lateral sub-teguminal process. g) In forewing, R_2 is more often separated from R_{3+4}; vein Cu_2 is present and confined to terminal part. h) In forewing, R_2 is stalked with R_{3+4} and vein Cu_2 is absent. i) Valve of male genitalia without costal process. j) Valve of male genitalia with costal process. k) Praecinctorium is dorsally bilobed. l) Praecinctorium is simple.

Subfamily GALLERIINAE Zeller, 1848; type genus: *Galleria* Fabricius, 1798

= Macrotheciinae Barnes and McDunnough, 1912

Genus: *CORCYRA* Ragonot, 1885; type species : *Melissoblaptes cephalonica* Stainton,1866

= *Tineopsis* Dyar, 1913; type species: *Tineopsis theobromae* Dyar, 1913

***Corcyra cephalonica* (Stainton, 1866) (Melissoblaptes);** type locality: Great Britain

= *Anerastia lineata* Legrand, 1966

= *Corcyra translineella* Hampson and Joannis in Ragonot and Hampson, 1901; type locality: Réunion

= *Melissoblaptes oeconomellus* Mann, 1872; type locality: Bulgaria; Hampson 1917: (syn.)

= *Tineopsis theobromae* Dyar, 1913; type locality: USA, Pennsylvania, Pittsburgh W. T. M. Forbes 1923: (syn.)

Genus: *LAMORIA* Walker, 1863; type species: *Lamoria planalis* Walker, 1863

= *Hornigia* Ragonot, 1885; type species: *Tinea anella* (Denis and Schiffermüller), 1775

= *Lammoria* Turner, 1905

= *Maraclea* Walker, 1863; type species: *Maraclea inostentalis* Walker, 1863

= *Microcyttara* Turner, 1913; type species: *Microcyttara eumeces* Turner, 1913

M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Tugela* Ragonot, 1888; type species: *Tugela clathrella* Ragonot, 1888 Viette 1990 : (syn.)

***Lamoria adaptella* (Walker, 1863)(Pempelia);** type locality: Ceylon (Sri Lanka)

= *anella* Hampson, 1896

= *Crambus foedellus* Walker, 1866; type locality: (Indonesia), Flores, Ragonot and Hampson 1901 (syn.)

= *Lamoria bipunctanus* Moore, 1886; type locality: Ceylon (Sri Lanka)

= *Lamoria fusconervella* Ragonot, 1888; type locality: Indonesia, Sumatra Hampson 1917: (syn.)

Genus: *PARALIPSA* Butler, 1879: type species: *Paralipsa modesta* Butler, 1879

= *Paralispa* Rebel, 1910

***Paralipsa gularis* (Zeller, 1877) (Melissoblaptes);** type locality: Japan

= *Melissoblaptes tenebrosus* Butler, 1879; type locality: Japan;
Ragonot and Hampson 1901: (syn.)

= *Paralipsa modesta* Butler, 1879; type locality: Japan; Hampson 1917: (syn.)

Genus: *STENACHROIA* Hampson, 1898; type species: *Stenachroia elongella* Hampson, 1898

***Stenachroia elongella* Hampson, 1898;** type locality: India, Assam

Genus: *TIRATHABA* Walker, 1864; type species: *Tirathaba mundella* Walker, 1864

= *Coleoneura* Ragonot, 1888; type species: *Coleoneura tacanovella* Ragonot, 1888

= *Harpagoneura* Butler, 1885; type species: *Harpagoneura complexa* Butler, 1885

= *Harpagomorpha* Turner, 1937

= *Metachrysia* Hampson in Ragonot and Hampson, 1901; type species:
Metachrysia acyperella Hampson, 1901
Whalley 1964 : (syn.)

= *Mucialla* Walker, 1866; type species: *Mucialla mundella* Walker, 1866

= *Suisharyona* Strand, 1920; type species: *Suisharyona aperta* Strand, 1920;
Whalley 1964: (syn.)

***Tirathaba mundella* Walker, 1864;** type locality: Malaysia, Sarawak

= *Melissoblaptes fructivora* Meyrick, 1933; type locality: Malaysia;
Whalley 1964: (syn. n.)

= *Mucialla mundella* Walker, 1866; type locality: Malaysia, Sarawak;
Ragonot and Hampson 1901: (syn.)

Subfamily PHYCITINAE Zeller, 1839; type genus: *Phycidea* Zeller, 1839

Genus: *ACROBASIS* Zeller, 1839 (Nephopteryx); type species: *Tinea consociella* Hübner, 1813

= *Acrocaula* Hulst, 1900; type species: *Acrocaula comacornella* Hulst, 1900;
Heinrich 1956: (syn.)

= *Catacrobasis* Gozmány, 1958; type species: *Tinea obtusella* Hübner, 1796;

Hannemann 1964: (syn.)

= *Conobathra* Meyrick, 1886; type species: *Conobathra automorpha* Meyrick, 1886;

P. Leraut 2005: (syn.)

= *Cyphita* Roesler, 1971; type species: *Myelois rufofusellus* Caradja, 1931;

Roesler 1985: (syn.)

= *Cyprusia* Amsel, 1958; type species: *Cyprusia wiltshirei* Amsel, 1958

= *Mineola* Hulst, 1890; type species: *Myelois indigenella* Zeller, 1848;

Heinrich 1956: (syn.)

= *Numonia* Ragonot, 1893; type species: *Numonia cymindella* Ragonot, 1893

Roesler 1987: (syn.)

= *Styphlorachis* Hampson, 1930; type species: *Styphlorachis mesophaea* Hampson, 1930

Roesler 1985: (syn.)

= *Seneca* Hulst, 1890; type species: *Cateremna tumidulella* Ragonot, 1887;

Heinrich 1956: (syn.)

= *Trachycera* Ragonot, 1893; type species: *Rhodophaea pallicornella* Ragonot, 1887;

P. Leraut 2005: (syn.)

= *Hylopylora* Meyrick, 1933; type species: *Hylopylora craterantis* Meyrick, 1933;

Roesler 1987: (syn.);

= *Hylophora* Whalley, 1970

= *Rhodophaeopsis* Amsel, 1950; type species: *Rhodophaea iranalis* Amsel, 1950

***Acrobasis pirivorella* (Matsumura, 1900) ;** type locality: Japan, Sapporo and Tokyo

= *Nephopteryx pauperculella* Wileman, 1911

= *Numonia pyrivora* Gerasimov, 1926; type locality: Chabarovsk;

Gerasimov 1929: (syn.)

Genus: *ANONAEPESTIS* Ragonot, 1894 ; type species: *Anonaepestis bengalella* Ragonot, 1894

***Anonaepestis bengalella* Ragonot, 1894**

Genus: *APOMYELOIS* Heinrich, 1956; type species: *Dioryctria bistriatella* Hulst, 1887

= *Ectomyelois* Heinrich, 1956; type species: *Myelois decolor* Zeller, 1881; P. Leraut 2002: (syn.)

***Apomyelois ceratoniae* (Zeller, 1839) ;** type locality: Austria, Laibach

= *durandi* D. Lucas, 1950

= *Euzophera zellerella* Sorhagen, 1881; type locality: unknown; Ragonot 1893: (syn.)

= *Heterographis rivularis* Warren and Rothschild, 1905; type locality: Sudan, Atbara River, Nakheila; Roesler 1973: (syn.)

= *Hypsipyla psarella* Hampson, 1903; type locality: India

= *Myelois oporedestella* Dyar, 1911; type locality: USA, Florida, Miami; Heinrich 1956: (syn.)

= *Myelois phoenicis* Durrant, 1915; type locality: Algeria

= *Myelois tuerckheimella* Sorhagen, 1881

= *Myelois tuerkheimiella* Sorhagen, 1881; type locality: unknown; Ragonot 1893: (syn.)

= *Phycis ceratoniella* Fischer von Röslerstamm, 1839; Ragonot 1893: (syn.)

= *Phycita dentilinella* Hampson, 1896; type locality: N.E. India, Manipur; Roesler and Küppers 1981:(syn.)

= *Trachonitis pryerella* Vaughan, 1870; type locality: England, London; Ragonot 1893: (syn.)

Genus: *CADRA* Walker, 1864; type species: *Cadra defectella* Walker, 1864

= *Xenephestia* Gozmány, 1958; type species: *Pempelia cautella* Walker, 1863

***Cadra cautella* (Walker, 1863: 73) (*Pempelia*);** type locality: Sri Lanka

= *Cadra defectella* Walker, 1864; type locality: Sri Lanka

= *Cryptoblabes formosella* Wileman and South, 1918; type locality: China, Taiwan, Kaohsiung

= *Ephestia irakella* Amsel, 1959; type locality: Iraq, Bagdad;
Roesler 1966: (syn.)

= *Ephestia passulella* Barrett, 1875; type locality: Great Britain, England

= *Ephestia pelopis* Turner, 1947; type locality: Australia;
M. Shaffer, Nielsen and Horak 1996 : (syn.)

= *Ephestia rotundatella* Turati, 1930; type locality: Libya, Cyrenaika

= *Nephopteryx desuetella* Walker, 1866; type locality: Australia, Queensland, Moreton Bay

Genus: *CITRIPESTIS* Ragonot, 1893; type species: *Nephopterix sagittiferella* Moore, 1891

= *Philotroctis* Meyrick, 1933; type species: *Philotroctis eutraphera* Meyrick, 1933; Roesler 1983: (syn.)

***Citripestis eutraphera* (Meyrick, 1933) (*Myelois*);** type locality: Indonesia, Java;
Roesler 1983 (*Citripestis*)

Genus: *COPAMYNTIS* Meyrick, 1934; type species: *Elegia alectryonura* Meyrick, 1932

= *Compamyntis* Roesler and Küppers, 1979

***Copamyntis infusella* (Meyrick, 1879) (*Nephopteryx*);** type locality: Australia, Queensland, neighbourhood of Duaringa

= *bipartella* Hampson 1986

Genus: *CRYPTOBLABES* Zeller, 1848; type species: *Ancylosis rutilella* Zeller, 1839

= *Albinia* Briosi, 1877; type species: *Albinia wockiana* Briosi, 1877

***Cryptoblabes angustipennella* Ragonot, 1888;** type locality: Indies ("Indes orientales"), Punjab

***Cryptoblabes gnidiella* (Millière, 1867) (*Ephestia*);** type locality: Spain, Barcelona. France, Alpes-Maritimes, Cannes; Ragonot 1893: (*Cryptoblabes*)

= *Albinia wockiana* Briosi, 1877; Ragonot 1893: (syn.)

= *Cryptoblabes aliena* Swezey, 1909; type locality: USA, Hawaii, Honolulu;
Zimmerman 1972: (syn.)

Genus: *DIORYCTRIA* Zeller, 1846; type species: *Tinea abietella* (Denis and Schiffermüller), 1775

= *Dioryctriodes* Mutuura and Munroe, 1974; type species: *Dioryctriodes daelei* Mutuura and Munroe, 1974; Speidel and Asselbergs 2000: (syn.)

= *Ocrisia* Ragonot, 1893; type species: *Myelois robiniella* Millière, 1865; Speidel and Asselbergs 2000: (syn.)

= *Pinipestis* Grote, 1878; type species: *Nephopterix zimmermanni* Grote, 1877; Ragonot 1893: (syn.)

***Dioryctria castanea* Bradley, 1969;** type locality: India, Assam, Um Japung

Genus: *EMMALOCERA* Ragonot, 1888; type species: *Emmalocera crenatella* Ragonot, 1888

= *Ambala* Ragonot, 1888; type species: *Ambala fuscostrigella* Ragonot, 1888; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Baroda* Ragonot, 1888; type species: *Baroda paucigraphella* Ragonot, 1888; M. Shaffer, Nielsen and Horak 1996: (hom.)

= *Critonia* Ragonot, 1891; type species: *Critonia subconcinnella* Ragonot, 1891

= *Enosima* Ragonot in Ragonot and Hampson, 1901; type species: *Enosima neesimella* Ragonot, 1901; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Lodiana* Ragonot, 1888; type species: *Lodiana umbrivittella* Ragonot, 1888; Hampson 1918: (syn.)

= *Papua* Ragonot, 1890; type species: *Papua latilimbella* Ragonot, 1890; Hampson 1918: (syn.)

= *Pectinigeria* Ragonot, 1888; type species: *Pectinigeria macrella* Ragonot, 1888; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Poujadia* Ragonot, 1888; type species: *Poujadia sepicostella* Ragonot, 1888; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Rhinaphe* Berg, 1875; type species: *Rhinaphe signicollis* Berg, 1875

= *Ampycophora* Meyrick, 1882; type species: *Pempelia apotomella* Meyrick, 1879

= *Phinaphe* Berg, 1875

= *Singhaliella* Strand, 1920; type species: *Critonia simplicipalpis* Strand, 1920

= *Socora* Ragonot, 1888; type species: *Socora tenuicostella* Ragonot, 1888;
M. Shaffer, Nielsen and Horak 1996: (syn.)

***Emmalocera depressella* Swinh.**

= *Melissoblaptes depresella* Swinhoe 1885

= *Polyocha depressella* Hampson 1896

= *Polyocha saccharella* Dudgeon 1905

Genus: *EPHESTIA* Guenée, 1845; type species: *Tinea elutella* Hübner, 1796

= *Anagasta* Heinrich, 1956; type species: *Ephestia kuehniella* Zeller, 1879

= *Hyphantidium* Scott, 1859; type species: *Hyphantidium sericarium* Scott, 1859

***Ephestia kuehniella* Zeller, 1879;** type locality: Germany

= *Ephestia (Anagasta) kuehniella* f. *alba* Roesler, 1966 (infrasubsp.); type locality: (no locality given)

= *Ephestia* (*Anagasta*) *kuehniella* f. nigra Roesler, 1966 (infrasubsp.); type locality: Germany

= *Ephestia fuscofasciella* Ragonot, 1887; type locality: USA, Texas

= *Ephestia gitonella* Druce, 1896; type locality: Mexico, Durango

= *Homoeosoma ischnomorpha* Meyrick, 1931; type locality: New Zealand, Whangarei; Roesler 1973: (syn.)

Genus: *ETIELLA* Zeller, 1839; type species: *Phycis zinckenella* Treitschke, 1832

= *Alata* Walker, 1863; type species: *Alata anticalis* Walker, 1863

= *Arucha* Walker, 1863; type species: *Arucha indicatalis* Walker, 1863

= *Ceratamma* Butler, 1881; type species: *Ceratamma hobsoni* Butler, 1881

= *Mella* Walker, 1859; type species: *Mella dymnusalis* Walker, 1859

= *Modiana* Walker, 1863; type species: *Modiana scitivittalis* Walker, 1863

= *Rhamphodes* Guenée, 1845; type species: *Phycis etiella* Treitschke, 1835;
Viette 1990: (syn.)

***Etiella zinckenella* (Treitschke, 1832) (*Phycis*);** type locality: Italy, Sicily

= *Alata anticalis* Walker, 1863; type locality: Sierra Leone; Ragonot 1893: (syn.)

= *Alata hastiferella* Walker, 1866; type locality: Colombia, Santa Marta ; Ragonot 1893: (syn.)

= *Arucha indicatalis* Walker, 1863; type locality: South Africa; Ragonot 1893: (syn.)

= *Crambus sabulinus* Butler, 1879; type locality: Japan; Ragonot 1893: (syn.)

= *Etiella (Pempelia) zinckenella ab. decipiens* Staudinger, 1870; type locality: Spain, Andalusia, Granada

= *Etiella madagascariensis* Saalmüller, 1880; type locality: Madagascar Ragonot 1893: (syn.)

= *Etiella rubribasella* Hulst, 1890; type locality: USA, Florida

= *Etiella schisticolor* Zeller, 1881; type locality: USA, California

= *Etiella villosella* Hulst, 1887; type locality: USA, Colorado; Ragonot 1893: (syn.)

= *marginella* Fabricius 1781

= *Mella dymnusalis* Walker, 1859; type locality: Sierra Leone; Ragonot 1893: (syn.)

= *Modiana scitivittalis* Walker, 1863: 83; type locality: Australia, Queensland, Moreton Bay Ragonot 1893: (syn.)

= *Etiella sincerella* Meyrick, 1879 ; type locality: Australia, Sydney, Gladesville

= *Pempelia spartiella* Rondani, 1876; Ragonot 1893: (syn.)

= *Phycis etiella* Treitschke, 1835; type locality: Italy; Ragonot 1893: (syn.)

= *Rhamphodes heraldella* Guenée, 1862; type locality: France, La Réunion

= *Tinea (Chilo) colonnellus* O.-G. Costa, 1836; type locality: Italy, Napoli Ragonot 1893:(syn.)

= *Tinea (Chilo) majorellus* O.-G. Costa, 1836; type locality: Italy, Napoli Ragonot 1893: (syn.)

Genus: *EUZOPHERA* Zeller, 1867; type species: *Myelois cinerosella* Zeller, 1839

= *Ahwazia* Amsel, 1949; type species: *Ahwazia albocostalis* Amsel, 1949; Roesler 1973: (syn.)

= *Cymbalorissa* Gozmány, 1958; type species: *Stenoptycha fuliginosella;* Heinemann, 1865

= *Longignathia* Roesler, 1965; type species: *Longignathia cornutella* Roesler, 1965 Roesler 1973:(syn.)

= *Melia* Heinemann, 1865; type species: *Myelois cinerosella* Zeller, 1839

= *Pistogenes* Meyrick, 1937; type species: *Pistogenes mercatrix* Meyrick, 1937; Roesler 1973: (syn.)

= *Quadrempista* Roesler, 1973; type species: *Euzophera ultimella* Roesler, 1973

= *Stenoptycha* Heinemann, 1865; type species: *Myelois cinerosella* Zeller, 1839

***Euzophera perticella* Ragonot, 1888;** type locality: India, Kolkata

= *Euzophera nilghirisella* Ragonot, 1893; type locality: India, Calcutta; Roesler 1973: (syn.)

***Euzophera bigella* (Zeller, 1848) (*Ephestia*);** type locality: Italy, Tuscany, Livorno, Antignano

= *Ephestia egeriella* Millière, 1873; type locality: (not given); P. Leraut 2008: (syn.)

= *Euzophera bisinuella* Ragonot, 1887; type locality: Iran, Schahkuh; Roesler 1973:(syn.)

= *Euzophera immundella* Ragonot and Hampson, 1901; type locality: Europe; Roesler 1973: (syn.)

= *Euzophera renulella* Costantini, 1922; type locality: Italy (Saliceta S. G.), Mutina; Roesler 1973: (syn.)

= *Euzopherodes angulella* Chrétien in Oberthür, 1922; type locality: Morocco; Roesler 1973: (syn.)

= *Homoeosoma stenoptycha* Herrich-Schäffer, 1849; type locality: not given; Herrich-Schäffer 1849 : (syn.)

= *Nephopteryx punicaeella* Moore, 1891; type locality: Balochistan (“Belutschistan”), Pomey Yante

= *Tinea stenoptycha* Herrich-Schäffer, 1855; type locality: Poland, G³ogów

Genus: *HYPSIPYLA* Ragonot, 1888; type species: *Hypsipyla pagodella* Ragonot, 1888

***Hypsipyla robusta* (Moore, 1886; (*Magiria*);** type locality: Sri Lanka

Ragonot 1893: (*Hypsipyla*)

= *Epicrocis terebrans* Olliff, 1890; type locality: New South Wales;
M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Hypsipyla pagodella* Ragonot, 1888; type locality: Indes orientales;
Ragonot 1893: (syn.)

= *Hypsipyla scabrusculella* Ragonot, 1893; type locality:Madagascar;
Bradley 1968: (syn.)

Genus: *MUSSIDIA* Ragonot, 1888; type species: *Mussidia nigrivenella* Ragonot, 1888

= *Muscidia* Sharp, 1890

***Mussidia pectinicornella* (Hampson, 1896); (*Myelois*);** type locality: Bhután

Genus: *NEPHOPTERIX* Hübner, 1825; type species: *Tinea angustella* Hübner,1796

= *Alispa* Zeller, 1848; type species: *Tinea angustella* Hübner, 1796

= *Nephopteryx* Zeller, 1839

***Nephopterix eugraphella* Ragonot, 1888;** type locality: Indies

Genus: *PHYCITA* J. Curtis, 1828; type species: *Tinea spissicella* Fabricius, 1794

= *Phycis* Fabricius, 1798; type species: *Tinea spissicella* Fabricius, 1794

= *Ceratium* Thienemann, 1828

= *Gyra* Gistel, 1848

***Phycita clientella* (Zeller, 1867); (*Nephopteryx*);** type locality: India, Calcutta

Genus: *PLODIA* Guenée, 1845; type species: *Tinea interpunctella* Hübner, (1813)

***Plodia interpunctella* (Hübner, 1810–1813) (*Tinea*);** type locality: Europe

= *Ephestia glycinivora* Matsumura, 1917; type locality: Japan, Hokkaido

= *Ephestia glycinivorella* Matsumura, 1932

= *Plodia interpunctella v. castaneella* Reutti, 1898; type locality: Germany,
Pfalz, Speyer

= *Tinea interpunctalis* Hübner, 1825; type locality: presumably Germany

= *Tinea zeae* Fitch, 1856; type locality: USA, New York

= *Unadilla latercula* Hampson, 1901; type locality: Bahamas, Nassau; Heinrich 1956: (syn.)

Genus: *SALURIA* Ragonot, 1887; type species: *Saluria maculivittella* Ragonot, 1887

***Saluria inficita* Walker, 1863**

Genus: *ZONULA* J. C. Shaffer, 1995: 94

= *Hyalospila* Ragonot, 1888; type species: *Hyalospila stictoneurella* Ragonot, 1888

***Zonula leuconeurella* (Ragonot, 1888) (*Hyalospila*);** type locality: Sulawesi

Family CRAMBIDAE

Subfamily ACENTROPINAE Stephens, 1836; type genus: *Acentropus* Curtis, 1834

= Aquaticae Hübner, 1796; type genus: The family group name Aquaticae is not based on an existing genus group name

= Argyractini Lange, 1956; type genus: *Argyractis* Hampson, 1897

= Cataclystae Hübner, 1825

= Chloephila Guilding, 1830

= Elophilae Hübner, 1825

= Kamptoptera Guilding, 1830

= Lathrotelidae J. F. G. Clarke, 197; type genus: *Lathroteles* Clarke.

= Nymphulae Hübner, 1825

= Nymphulites Duponchel, 1845; type genus: *Nymphula* Schrank, 1802

= Hydrocampidae Guenée, 1854; type genus: *Hydrocampa* Stephens, 1829

= Parapoynges Hübner, 1825

= Acentridae A. Speyer, 1869; type genus: *Acentria* Stephens, 1829

= Acentropodidae Dunning, 1872

Genus: *PARAPONYX* Hubner, 1825; type species: *Phalaena stratiota* Linn.1758

= *Paraponyx* Hübner, 1825; type species: *Phalaena stratiotata* Linnaeus, 1758

= *Nymphula*, Schrank, 1802; type species *N. nymphceata*, Linn, from Europe.

= *Cosmophylla* Turner, 1908; type species: *Cosmophylla oxygramma* Turner,1908

= *Eustales* Clemens, 1860; type species: *Eustales tedyuscongalis* Clemens,1860

= *Hydreuretis* Meyrick, 1885; type species: *Hydrocampa tullialis* Walker, 1859

= *Microdracon* Warren, 1890; type species: *Oligostigma bilinealis* Snellen,1876

= *Nymphaeella* Grote, 1880; type species: *Nymphaeella dispar* Grote, 1880

= *Paraponyx* Guenée, 1854

= *Sironia* Clemens, 1860; type species: *Sironia maculalis* Clemens, 1860

Paraponyx stagnalis **(Zeller, 1852)**

= *Nymphula stagnalis* (Zeller, 1852); type locality: Natal (South Africa)

= *Cataclysta vestigialis* Snellen, 1880; type locality: Sumatra (Indonesia)

= *Hydrocampa depunctalis* Guenée, 1854; type locality: Indes orientales

= *Hydrocampa hilli* Tepper, 1890; type locality: N. W. Victoria(Australia)

= *Zebronia decussalis* Walker, 1859; type locality: Sri Lanka

= *Nymphula depunctalis*, Guen.

Subfamily CRAMBINAE Latreille, 1810; type genus: *Crambus* Fabricius, 1798

= Ancylolomidae Ragonot and Ragonot, 1889; type genus: *Ancylolomia* Hübner, 1825

= Crambina Zeller, 1847: type genus: *Crambus* Fabricius, 1798

= Tetrachila Hübner, 1818

Genus: *ANCYLOLOMIA* Hübner, 1825; type species: *Tinea palpella* Denis and Schiffermüller, 1775,

= *Jartheza* Walker, 1863; type species: *Chilo chrysographellus* Kollar, 1848

= *Pseudoctenella* Strand, 1907; type species: *Ctenus malacellus* Mabille, 1906

= *Ctenus* Mabille, 1906; type species: *Ctenus malacellus* Mabille, 1906

= *Tollia* Amsel, 1949; type species: *Crambus pectinatellus* Zeller, 1847

Ancylolomia chrysographellus **(Kollar and Redtenbacher, 1844) (*Chilo*);** type locality: Mussourie, Uttarakhand (India)

= *Ancylolomia basistriga* Moore, 1886; type locality: (Sri Lanka) Ceylon, Neuera Eliza Bleszynski 1970: (syn.)

= *bassistriga* Bleszynski & Collins, 1962

= *Jartheza cassimella* Swinhoe, 1887; type locality: India, Mhow;
Bleszynski 1970 : (syn.)

= *Jartheza responsella* Walker, 1863; type locality: (India, Hindustan), North Hindostan

= *Jartheza xylinella* Walker, 1863; type locality: Nepal; Bleszynski 1970: (syn.)

Genus: *CHILO* Zincken, 1817; type species: *Tinea phragmitella* Hübner, 1810

= *Borer* Guenée, 1862; type species: *Phalaena saccharalis* Fabricius sensu Guenée,1862 (= *Proceras sacchariphagus* Bojer *et al.,* 1856)

Tams 1942: 67 (syn.)

= *Chilona* Sodoffsky, 1837

= *Chilotraea* Kapur, 1950; type species: *Chilo infuscatellus* Snellen, 1890;
Bleszynski 1962 : (syn.)

= *Diphryx* Grote, 1881 ; type species: *Diphryx prolatella* Grote, 1881;
Hampson 1896: (syn.)

= *Hypiesta* Hampson, 1919 ; type species: *Hypiesta argyrogramma* Hampson, 1919;
Bleszynski 1965: (syn.)

= *Nephalia* Turner, 1911; type species: *Nephalia crypsimetalla* Turner, 1911;
Bleszynski 1966: (syn.)

= *Silveria* Dyar, 1925; type species: *Silveria hexhex* Dyar, 1925

***Chilo auricilia* Dudgeon, 1905;** type locality: India, Bihar

= *Chilo popescugorji* Bleszynski, 1963; type locality: China, Taiwan;
Bleszynski 1970: (syn.)

***Chilo batri* (Fletcher, 1928) (*Diatraea*);** type locality: India, Bihar

***Chilo ikri* (Fletcher, 1928) (*Diatraea*);** type locality: India, Bihar

***Chilo infuscatellus* Snellen, 1890; type locality: Indonesia, Java**

= *infuscatellus* Snellen, 1890; type locality: Indonesia, Java

= *Argyria coniorta* Hampson, 1919; type locality: Bengal, Bihar Pusa (India)

= *Argyria sticticraspis* Hampson, 1919; type locality: Coimbator (India)

= *Chilo tadzhikiellus* Gerasimov, 1949

= *Diatraea calamina* Hampson, 1919; type locality: India and Burma,

= *Diatraea shariinensis* Eguchi, 1933

***Chilo kanra* (Fletcher, 1928) (*Diatraea*);** type locality: India

= *Chilo saccharicola* Fletcher, 1928; type locality: India; Bradley 1982: (syn.)

***Chilo polychrysus* (Meyrick, 1932) (*Diatraea*);** type locality: (Indonesia) Malaya Pen., Malacca

= *polycgrysus* Hua, 2005

***Chilo partellus* (Swinhoe, 1886); type locality: Poona, Mumbai (India).**

= *partellus* (Swinhoe, 1886) (Crambus); type locality: Mumbai, Poona (India)

= *Chilo partellus acutus* Bhattacherjee, 1971; type locality: Skkur, Junagadh, Surendra Nagar; and Kothara (India)

= *Chilo lutulentalis* Tams, 1932; type locality: Malawi (Nyasaland)

= *Chilo partellus coimbatorensis* Bhattacherjee, 1971; type locality: Dehli, Coimbatore, Poona and Dharwar (India)

= *Chilo partellus kanpurensis* Bhattacherjee, 1971; type locality: India, UnitedProvinces and Cawnpore

= *kaanpurense* Vári, Kroon and Krüger, 2002

= *zonellus* (Swinhoe, 1884) (Crambus); type locality: Karachi

***Chilo sacchariphagus indicus* (Kapur) (*Proceras*);** type locality: Mauritius; Bleszynski 1966: (*Chilo*)

= *Argyria straminella* Caradja, 1926; type locality: China, Tsingtan

= *Borer saccharellus* Guenée, 1862; type locality: Réunion; Tams 1942 (syn.)

= *Chilo mauriciellus* Walker, 1863; type locality: Mauritius

= *Chilo venosatus* Walker, 1863; type locality: (Malaysia) Sarawak, Borneo; Bleszynski 1970: (syn.)

= *venosatum* Hua, 2005

= *Diatraea striatalis* Snellen, 1890 Hampson 1896: (syn.)

= *Chilo sacchariphagus stramineella* (Caradja, 1926) (Argyria); type locality: China, Tsingtau

***Chilo suppressalis* (Walker, 1863) (*Crambus*);** type locality: (China, Kiangsu), Shanghai

= *Chilo oryzae* Fletcher, 1928; type locality: India, Pusa; Kawada 1930: (syn.)

= *Jartheza simplex* Butler, 1881; type locality: (China, Taiwan) Formosa; Vinson 1942: (syn.)

= *suppresalis* Hampson, 1896

***Chilo tumidicostalis* (Hampson, 1919) (*Argyria*);** type locality: (India) Bengal, Patna

= *Chilo gemininotalis* Hampson, 1919; type locality: (India) Cachar, Kanny Koory; Fletcher 1928: (syn.)

Subfamily CYBALOMIINAE Marion, 1955; type genus: Cybalomia Lederer, 1863

Genus*: HENDECASIS* Hampson, 1896; type species: *Trichophysetis duplifascialis* Hampson, 1891

= *Neohendecasis* Shibuya, 1931; type species: *Pyralis apiciferalis* Walker, 1866

Hendecasis duplifascialis Hampson 1891

= *Trichophysetis duplifascialis*.

Subfamily GLAPHYRIINAE W. T. M. Forbes, 1923; type genus: *Glaphyria* Hübner, 1823

= Agastia Moore, 1881

= Evergestinae Marion, 1952; type genus: *Evergestis* Hübner, 1825

= Evergestini Marion, 1952; type genus: *Evergestis* Hübner, 1825

= Evergestrinae P. Leraut, 2008

= Orenaiini P. Leraut, 1997; type genus: *Orenaia* Duponchel, 1845

= Homophysidae Lederer, 1863; type genus: *Homophysa* Guenée, 1854

= Noordinae Minet, 1980; type genus: *Noorda* Walker, 1859

Genus: *CROCIDOLOMIA* Zeller, 1852; type species: *Crocidolomia binotalis* Zeller, 1852

= *Godara* Walker, 1859; type species: *Pionea comalis* Guenée, 1854

= *Pseudopisara* Shiraki, 1913; type species: *Pseudopisara quadripunctata* Shiraki,1913

= *Tchahbaharia* Amsel, 1951; type species: *Tchahbaharia dentalis* Amsel, 1951

Crocidolomia pavonana **(Fabricius, 1794) (*Pyralis*);** type locality: (India), Tranquebariae

M. Shaffer, Nielsen and Horak 1996: (*Crocidolomia*)

= *Crocidolomia binotalis* Zeller, 1852 M. Shaffer, Nielsen & Horak 1996: (syn.)

= *Pionea comalis* Guenée, 1854; type locality: Central India

= *Pionea incomalis* Guenée, 1854

= *Pseudopisara quadripunctata* Shiraki, 1913; type locality: China, Taiwan

= *Tchahbaharia dentalis* Amsel, 1951; type locality: Iran

Genus: *HELLULA* Guenée, 1854: 415; type species: *Phalaena undalis* Fabricius, 1781

= *Ashwania* Pajni and Rose, 1977; type species: *Ashwania reniculus* Pajni and Rose, 1977; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Oeobia* Hübner, 1825; type species: *Phalaena undalis* Fabricius, 1781

= *Oebia* Hübner, 1825

= *Phyratocosma* Meyrick, 1936; type species: *Phyratocosma trypheropa* Meyrick, 1936; Munroe 1972: (syn.)

Hellula undalis **(Fabricius, 1781) (*Phalaena*);** type locality: Italy

= *Ashwania reniculus* Pajni and Rose, 1977

M. Shaffer, Nielsen & Horak 1996: (syn.)

= *Evergestis occidentalis* Joannis, 1930; type locality: Morocco

M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Leucinodes exemptalis* Walker, 1866; type locality: China

= *lunulalis* (Costa,1836)

= *Pionea geyri* Rothschild, 1915

= *Scoparia alconalis* Walker, 1859; type locality: Sri Lanka (Ceylon)

Swinhoe and Cotes 1889: (syn.)

Subfamily SCHOENOBIINAE Duponchel, 1846; type genus: *Schoenobius* Duponchel, 1846

Genus: *SCIRPOPHAGA* Treitschke, 1832; type species: *Tinea phantasmatella* Hübner, 1796

***Scirpophaga excerptalis* (Walker, 1863) (*Chilo*);** type locality: (India) North Hindostan

= *Scirpophaga butyrota* Meyrick, 1889; type locality: New Guinea, Port Moresby; Lewvanich 1981: (syn.)

= *Scirpophaga intacta* Snellen, 1890; type locality: Indonesia, Java

= *Scirpophaga monostigma* Zeller, 1863; type locality: Unknown (Patria ignota); Lewvanich 1981: (syn.)

= *Topeutis rhodoproctalis* Hampson, 1919; type locality: Singapore; Lewvanich 1981: (syn.)

***Scirpophaga gilviberbis* Zeller, 1863;** type locality: (India) Calcutta

***Scirpophaga incertulas* Walker, 1863; Type locality: (Malaysia) Sarawak, Borneo**

= *Catagela admotella* Walker, 1863; type locality: Sri Lanka (Ceylon)

= *Chilo gratiosellus* Walker, 1864; type locality: Sri Lanka (Ceylon)

= *incertellus* (Walker, 1917)

= *Schoenobius minutellus* Zeller, 1863; type locality: Java (Indonesia)

= *Schoenobius punctellus* Zeller, 1863; type locality: Java (Indonesia) and Calcutta (India)

= *Tipanaea bipunctifera* Walker, 1863; type locality: Sarawak (Malaysia)

= *bipunctifer* (Strand, 1918) (Schoenobius)

= *Schoenobius bipunctifer ab. quadripunctellifera* Strand, 1918; type locality: Formosa and Kankan (Taiwan)

***Scirpophaga innotata* (Walker, 1863) (*Tipanaea*);** type locality: Malaysia, Sarawak

= *Scirpophaga sericea* Snellen, 1880; type locality: Indonesia, Sumatra, Solok; Soepajang

***Scirophaga nivella* (Fabricius, 1794) (*Tinea*);** type locality: India orientali

Lewvanich 1981 (*Scirpophaga*)

= *Schoenobius brunnescens* Moore, 1888; type locality: India, Calcutta; Lewvanich 1981:(syn.)

= *Schoenobius celidias* Meyrick, 1894; type locality: Indonesia, Borneo; Lewvanich 1981:(syn.)

= *Scirpophaga auriflua* Zeller, 1863; type locality: India, Calcutta; Caradja 1925: (syn.)

= *Scirpophaga chrysorrhoa* Zeller, 1863; type locality: Indonesia, Java, near Batavia Lewvanich 1981: (syn.)

= *Scirpophaga euclastalis* Strand, 1918; type locality: (China, Taiwan), Formosa, Anping Lewvanich 1981: (syn.)

Subfamily SPILOMELINAE Guenée, 1854; type genus: *Spilomela* Guenée, 1854

= Agroteridi Acloque, 1897; type genus: *Agrotera* Schrank, 1802

= Dichocrociinae Swinhoe, 1900; type genus: *Dichocrocis* Lederer, 1863

= Hapaliadae Swinhoe, 1890; type genus: *Hapalia* Hübner, 1818

= Hydririni Minet, 1982; type genus: *Hydriris* Meyrick, 1885

= Hymeniinae Swinhoe, 1900; type genus: *Hymenia* Hübner, 1825

= Lineodini Amsel, 1956; type genus: *Lineode*s Guenée, 1854

= Margarodidae Guenée, 1854; type genus: *Margarodes* Guenée, 1854

= Margaronidae Swinhoe and Cotes, 1889; type genus: *Margaronia* Hübner, (1825)

= Nomophilini Kuznetzov and Stekolnikov, 1979; type genus: *Nomophila* Hübner, 1825

= Siginae Hampson, 1918; type genus: *Siga* Hübner, 1820

= Steniadae Guenée, 1854; type genus: *Stenia* Guenée, (1845)

= Syleptinae Swinhoe, 1900; type genus: *Syllepte* Hübner, 1825

= Udeini P. Leraut, 1997; type genus: *Udea* Guenée in Duponchel, 1845

= Wurthiinae Roepke, 1916; type genus: *Wurthia* Roepke, 1916

Genus: *AGRIOGLYPTA* Meyrick, 1932: 244; type species: *Agrioglypta enneactis* Meyrick, 1932

***Agrioglypta itysalis* (Walker, 1859) (*Glyphodes*);** type locality: (Malaysia), Borneo, Sarawak; M. Shaffer, Nielsen and Horak 1996: (*Agrioglypta*)

= *Glyphodes piepersialis* Snellen, 1880; type locality: Indonesia, Sumatra, Ringkiang Loeloes

Genus: *AGROTERA* Schrank, 1802 ; type species: *Phalaena nemoralis* Scopoli, 1763

= *Agroptera* Hampson, 1899

= *Leucinodella* Strand, 1918; type species: *Leucinodella agroterodes* Strand, 1918

= *Nistra* Walker, 1859; type species: *Nistra coelatalis* Walker, 1859; Hampson 1896: (syn.)

= *Sagariphora* Meyrick, 1894; type species: *Sagariphora heliochlaena* Meyrick,1894

= *Tetracona* Meyrick, 1884; type species: *Aediodes amathealis* Walker, 1859

***Agrotera basinotata* Hampson, 1891;** type locality: India, Nilgiris, plateau

Genus: *ANTIGASTRA* Lederer, 1863; type species: *Botys catalaunalis* Duponchel, 1833

***Antigastra catalaunalis* (Duponchel, 1833) (Botys);** type locality: Spain, Barcelona

= *Antigastra catalaunalis ab. sionensis* Caradja, 1929 (infrasubsp.); type locality: Jordantal et Jericho

= *Botys venosalis* Walker, 1866; type locality: Congo. India

Genus: *CNAPHALOCROCIS* Lederer, 1863 ; type species: *Botys iolealis* Walker, 1859,

= *Cnaphalocrocis* Lederer, 1863; type species: *Botys iolealis* Walker, 1859,

= *Bradinomorpha* Matsumura, 1920; type species: *Bradinomorpha nawae* Matsumura, 1920.

= *Dolichosticha* Meyrick, 1884; type species: *Asopia venilialis* Walker, 1859

= *Epimima* Meyrick, 1886; type species: *Epimima stereogona* Meyrick, 1886

= *Lasiacme* Warren, 1896; type species*: Lasiacme pilosa* Warren, 1896

= *Marasmia* Lederer, 1863; type species: *Marasmia cicatricosa* Lederer, 1863

= *Neomarasmia* Kalra, David and Banerji, 1967

= *Prodotaula* Meyrick, 1934; type species: *Prodotaula conformis* Meyrick, 1934

= *Susumia* Marumo, 1930; type species: *Samea exigua* Butler, 1879

***Cnaphalocrocis bilinealis* (Hampson, 1891) (*Dolichosticha*);** type locality: S. India, Nilgiris

Cnaphalocrocis medinalis **Guenée, 1854*;* type locality: East India (Indes Orientales)**

= *Salbia medinalis* Guenée, 1854

= *Botys nurscialis* Walker, 1859; type locality: Moreton Bay and Sydney (Australia)

Cnaphalocrocis poeyalis **(Boisduval, 1833) (*Botys*);** type locality: Mauritius.

Réunion (Bourbon)

= *Asopia venilialis* Walker, 1859; type locality: Australia, Moreton Bay

= *venialis* (Gaede, 1916) (Marasmia)

= *Botys marisalis* Walker, 1859; type locality: Malaysia, Borneo, Sarawak.

Australia, Sydney

= *Botys minutalis* Mabille, 1879; type locality: Madagascar

= *Botys ruralis* Walker, 1859; type locality: Sri Lanka

= *Lasiacme mimica* Warren, 1896; type locality: India, Meghalaya, Khasi Hills

= *Marasmia cicatricosa* Lederer, 1863; type locality: Indonesia, Java

= *Marasmia hampsoni* Rothschild, 1921; type locality: Nigeria, Jigawa

= *Marasmia rectistrigosa* Snellen, 1872; type locality: Angola

Cnaphalocrocis trapezalis **Guenée, 1854; type locality: Sierra Leone**

= *trapezalis* (Guenée, 1854) (Salbia); type locality: Sierra Leone

= *Botys convectalis* Walker, 1866; type locality: India

= *Botys creonalis* Walker, 1859; type locality: Dominican Republic, Santo Domingo

= *Botys neoclesalis* Walker, 1859; type locality: Cape (South Africa)

= *Botys suspicalis* Walker, 1859; type locality: Sri Lanka (Ceylon)

= *Bradina andresi* Rebel, 1912

= *Cnaphalocrocis bifurcalis* Snellen, 1880; type locality: Indonesia, Celebes (Sulawesi)

= *Dolichosticha perinephes* Meyrick, 1886; type locality: Fiji

Genus: CONOGETHES *Conogethes punctiferalis*

Genus: *COPTOBASIS* Lederer, 1863; type species: *Desmia opisalis* Walker, 1859

Coptobasis textalis **Lederer, 1863;** type locality: East India

= *Coptobasis aenealis* Swinhoe, 1885; type locality: India, Pune, Mumbai

Genus: *DIAPHANIA* Hübner, 1818; type species: *Diaphania vitralis* Hübner, 1818

= *Diaphania* Stephens, 1829; type species: *Pyralis lucernalis* Hübner, 1796

= *Eudioptis* Hübner, 1823; type species: *Pyralis lucernalis* Hübner, 1796

= *Phakellura* Guilding, 1830; type species: *Phalaena hyalinata* Linnaeus, 1767

= *Phacellura* J. L. R. Agassiz, 1847

= *Sestia* Snellen, 1875; type species: *Sestia oleosalis* Snellen, 1875

M. Shaffer, Nielsen and Horak 1996: (syn.)

***Diaphania indica* (Saunders, 1851) (*Eudioptes*);** type locality: Indonesia, Java

= *Botys hyalinalis* Boisduval, 1833; type locality: Madagascar

= *Eudioptis capensis* Zeller, 1852; type locality: South Africa

= *Glyphodes intermedialis* Dognin, 1904; type locality: Paraguay

= *indicalis* Moore, 1867

= *Phakellura cucurbitalis* Guenée, 1862; type locality: Réunion

= *Phakellura gazorialis* Guenée, 1854; type locality: Indonesia, Java

= *garorialis* Snellen, 1882

= *Phakellura zygaenalis* Guenée, 1854; type locality: Israel / Palestinia, Judea

Genus: *GLYPHODES* Guenée, 1854; type species: *Glyphodes stolalis* Guenée, 1854

= *Caloptychia* Hübner, 1825; type species: *Phalaena chrysialis* Stoll, 1790

= *Calliptychia* J. L. R. Agassiz, 1847

= *Dysallacta* Lederer, 1863; type species: *Phalangiodes negatalis* Walker, 1859

Inoue 1982 (syn.)

= *Disallacta* Lederer, 1863

= *Morocosma* Lederer, 1863; type species: *Phalaena margaritaria* Clerck, 1764

***Glyphodes pulverulentalis* Hampson, 1896:** type locality: India, Nagas.

Myanmar/Thailand, Tenasserim

***Glyphodes pyloalis* Walker, 1859;** type locality: China

= *Glyphodes sylpharis* Butler, 1878; type locality: Japan

Butler 1879: (syn.)

Genus: *HARITALODES* Warren, 1890; type species: *Botys multilinealis* Guenée, 1854

***Haritalodes derogata* (Fabricius, 1775) (*Phalaena*);** type locality: India orientali

= *Botys multilinealis* Guenée, 1854; type locality: East India

= *Botys otysalis* Walker, 1859; type locality: Australia, Moreton Bay

= *Notarcha obliqualis* T. P. Lucas, 1898; type locality: Australia, Queensland, Brisbane; M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Zebronia salomealis* Walker, 1859; type locality: Sierra Leone; Moore 1877: (syn.)

Genus: *HERPETOGRAMMA* Lederer, 1863; type species: *Herpetogramma servalis* Lederer, 1863

= *Acharana* Moore, 1885; type species: *Botys otreusalis* Walker, 1859

= *Coremataria* Amsel, 1956; type species: *Botys infuscalis* Guenée, 1854; Munroe 1995: (syn.)

= *Culcitaria* Amsel, 1957; type species: *Botys infuscalis* Guenée, 1854

Munroe 1995: (nom. nud.)

= *Macrobotys* Munroe, 1950; type species: *Botys aeglealis* Walker, 1859

= *Pachyzancla* Meyrick, 1884; type species: *Botys mutualis* Zeller, 1852

= *Pantoeocome* Warren, 1896; type species: *Pantoeocome deformis* Warren, 1896

= *Piloptila* Swinhoe, 1894; type species: *Piloptila nigricornalis* Swinhoe, 1894

= *Ptiloptila* Hampson, 1899

= *Stenomelas* Hampson, 1912

= *Stenomeles* Warren, 1892; type species: *Botys agavealis* Walker, 1859; Munroe 1995 : (syn.)

***Herpetogramma basalis* (Walker, 1866) (*Botys*);** type locality: Sri Lanka (“Ceylon”)

= *Botys inanitalis* Lederer, 1863; type locality: East India, Indonesia, Moluccas, Ambon Island

= *Pyrausta dorsipunctalis* Rebel, 1892; type locality: Spain, Canary Is., La Palma, near Fuente de Aduarez, 600 m; Gran Canaria

= *dorcalis* (Alphéraki, 1889) (*Pyrausta*)

Genus: *LEUCINODES* Guenée, 1854; type species: *Leucinodes orbonalis* Guenée, 1854

= *Leuctinodes* South, 1897

= *Sceliodes* Guenée, 1854; type species: *Sceliodes mucidalis* Guenée, 1854; Mally, Korycinska, Agassiz, Hall, Hodgetts and Nuss 2015: (syn.)

= *Daraba* Walker, 1859; type species: *Daraba idmonealis* Walker, 1859; Hampson 1899: (syn.)

= *Eretria* Snellen, 1880; type species: *Eretria obsistalis* Snellen, 1880; Hampson 1899: (hom.)

***Leucinodes orbanalis* Guenée, 1854;** type locality: India. Indonesia, Java

Genus: *MALIARPHA* Ragonot, 1888; type species: *Maliarpha separatella* Ragonot, 1888

= *Ampycodes* Hampson in Ragonot and Hampson, 1901; type species: *Anerastia pallidicosta* Hampson, 1896; E. L. Martin 1958: (syn.)

= *Biafra* Ragonot, 1888; type species: *Biafra concinnella* Ragonot, 1888; Cook 1997: (syn.)

= *Ethiotropa* Hampson, 1918; type species: *Ethiotropa pyromerella* Hampson, 1918; Cook 1997: (syn.)

***Meliarpha separatella* Ragonot, 1888;** type locality: Cameroon

= *Anerastia pallidicosta* Hampson, 1896; E. L. Martin 1958: (syn.)

= *Enosima vectiferella* Ragonot and Hampson, 1901; type locality: Madagascar; Paulian and Viette 1955: (syn.)

Genus: *MARUCA* Walker, 1859 ; type species: *Hydrocampe aquitilis* Guérin-Méneville, (1832)

= *Maruea* Walker, 1859

= *Siriocauta* Lederer, 1863; type species: *Crochiphora testulalis* Geyer, 1832

***Maruca vitrata* (Fabricius, 1787) (Phalaena);** type locality: (India) Tranquebariae

Munroe 1995 : (*Maruca*)

= *Botys bifenestralis* Mabille, 1880; type locality: Madagascar;

Marion 1954 : (syn.)

= *Crochiphora testulalis* Geyer in Hübner, 1832; type locality: Argentina, Buenos-Aires

= *testulalis* (Geyer, 1931)

= *Hydrocampe aquitilis* Guérin-Méneville, 1832; type locality: Java

= *aquatilis* Shibuya, 1928

Genus: *NAUSINOE* Hübner, 1825; type species: *Phalaena pueritia* Cramer, (1780) 1779

= *Lepyrodes* Guenée, 1854; type species: *Lepyrodes geometralis* Guenée, 1854

= *Phalangiodes* Guenée, 1854; type species: *Phalaena pueritia* Cramer, (1780) 1779

Nausinoe geometralis (Guenée, 1854) (*Lepyrodes*); type locality: Central India

= *Nausinoe geometricalis* (Lederer, 1863)

Nausinoe pueritia (Cramer, 1780); type locality: Coromandel

= *Phalaena pueritia*

Genus: *OMIODES* Guenée, 1854; type species: *Omiodes humeralis* Guenée, 1854

= *Charema* Moore, 1888; type species: *Charema noctescens* Moore, 1888

= *Coenostola* Lederer, 1863; type species: *Botys origoalis* Walker, 1859

= *Coenolesta* Whalley, 1962

= *Deba* Walker, 1866; type species: *Deba surrectalis* Walker, 1866

= *Hedylepta* Lederer, 1863; type species: *Asopia vulgalis* Guenée, 1854; Munroe 1989: (syn.)

= *Hedilepta* Lederer, 1863

= *Heydelepta* Dyar, 1917

= *Lonchodes* Guenée, 1854; type species: *Lonchodes capillalis* Guenée, 1854; Munroe 1995 : (syn.)

= *Loxocreon* Warren, 1892; type species: *Salbia continuatalis* Wallengren, 1860; Zimmerman 1958: (syn.)

= *Merotoma* Meyrick, 1894; type species: *Botys dairalis* Walker, 1859; Munroe 1995 : (syn.)

= *Pelecyntis* Meyrick, 1884; type species: *Pyrausta absistalis* Walker, 1859

= *Phycidicera* Snellen, 1880; type species: *Phycidicera manicalis* Snellen, 1880 Munroe 1967:(syn.)

= *Spargeta* Lederer, 1863; type species: *Spargeta basalticalis* Lederer, 1863

***Omides diemenalis* (Guenée, 1854) (Asopia);** type locality: Tasmania

= *Asopia lydialis* Walker, 1859; type locality: Australia, Moreton Bay

= *Botys ustalis* Lederer, 1863; type locality: Indonesia, Ambon Island

= *diementalis* Inoue, 1996

= *Hedylepta pyraustalis* Snellen, 1880; type locality: Sumatra, Boea; Solok; Soepajang; Silago

= *Pyralis incertalis* Walker, 1866

= *Pyrausta absistalis* Walker, 1859; type locality: Sri Lanka (Ceylon), India

***Omides indicata* (Fabricius, 1775) (Phalaena);** type locality: India orientali

= *Asopia vulgalis* Guenée, 1854; type locality: Brazil, Guyana, Antilles

= *vulgaris* (Grünberg, 1910)

= *Botis fortificalis* Möschler, 1890; type locality: Puerto Rico

= *Botys connexalis* Walker, 1866; type locality: Dominican Republic

= *Botys dolosalis* Möschler, 1881; type locality: Surinam

= *Botys moeliusalis* Walker, 1859; type locality: Malaysia, Sarawak

= *Botys reductalis* Walker, 1866; type locality: China, prov. Fukien, Amoy

= *Botys sabalis* Walker, 1859: 631; type locality: Brazil, Rio de Janeiro

= *Nacoleia indicata ab. pigralis* Dognin, 1909: (infrasubsp.); type locality: French Guiana, Saint-Laurent du Maroni

= *Omiodes dnopheralis* Mabille, 1900; type locality: Madagascar, Antongil

= *Psara lionnetalis* Legrand, 1966

Genus: *PALPITA* Hübner, 1808; type species: *Pyralis unionalis* Hübner, 1796

= *Apyrausta* Amsel, 1951; type species: *Apyrausta persicalis* Amsel, 1951

= *Conchia* Hübner, 1821; type species: *Pyralis unionalis* Hübner, (1796)

= *Hapalia* Hübner, 1818; type species: *Hapalia illibalis* Hübner, 1818

= *Hvidodes* Swinhoe, 1900

= *Margarodes* Guenée, 1854; type species: *Pyralis unionalis* Hübner, 1796

= *Ledereria* Marschall, 1873

= *Margaronia* Hübner, 1825; type species: *Pyralis unionalis* Hübner, 1796

= *Paradosis* Zeller, 1852; type species: Paradosis villosalis Zeller, 1852

= *Sarothronota* Lederer, 1863; type species:
Phalaena flegia Cramer, 1777

= *Sebunta* Walker, 1863; type species: *Sebunta guttulosa* Walker, 1863

= *Sylora* Swinhoe, 1900; type species: *Sisyrophora cirralis* Swinhoe, 1897;
M. Shaffer, Nielsen and Horak 1996: (syn.)

= *Tobata* Walker, 1859; type species: *Tobata elealis* Walker, 1859

***Palpita vitrealis* (Rossi, 1794) (*Phalaena*);** type locality: Italy

= *Pyralis unionalis* Hübner, 1796; P. Leraut 1997: (syn.)

= *Botys quinquepunctalis* Boisduval, 1833; type locality: Mauritius, Bourbon (Reunion)

= *Margarodes septempunctalis* Mabille, 1880; type locality: Madagascar

= *Margarodes transvisalis* Guenée, 1854; type locality: Central Africa, Pays des Namaquois

Genus: *SPOLADEA* Guenée, 1854; type species: *Phalaena recurvalis* Fabricius, 1775

***Spolodea recurvalis* (Fabricius, 1775) (*Phalaena*);** type locality: India orientali

= *Hydrocampa albifacialis* Boisduval, 1833; type locality: Madagascar

= *albifascialis* (Boisduval, 1833) (*Hydrocampa*)

= *Hymenia diffascialis* Hübner, 1825

= *Hymenia exodias* Meyrick, 1904; type locality: Hawaii, Molokai, 1000 ft;
Zimmerman 1958: (syn.)

= *Nacoleia ancylosema* Dognin, 1909; type locality: French Guiana, Saint-Laurent du Maroni; Munroe 1995 : (syn.)

= *Odezia hecate var. formosana* Shiraki, 1910

= *Phalaena angustalis* Fabricius, 1787; type locality: (India), Tranquebariae

= *Phalaena Pyralis fascialis* Stoll in Cramer and Stoll, 1782; type locality: Japan

Table1. 1 Preliminary checklist of agriculturally important Pyraloidea in India

Species	Subfamily	Family	Host range
Acrobasis pyrivorella Matsumura	Phycitinae	Pyralidae	*Pyrus* sp
Agrioglypta itysalis Walker	Spilomelinae	Crambidae	*Ficus carica* L.
Agrotera basinotata Hamp.	Spilomelinae	Crambidae	*Syzygium buxifolium* (L.)
Ancylolomia chrysographella (Koll.)	Crambinae	Crambidae	*Sorghum bicolor* (L.), *Zea mays* L., etc.
Anonaepestis bengalella Ragonot	Phycitinae	Pyralidae	*Annona squamosa* L. and *Annona reticulata* L.
Antigastra catalaunalis (Duponchel)	Spilomelinae	Crambidae	*Sesamum indicum* L.
Apomyelois caratoniae Zeller	Phycitinae	Pyralidae	*Punica granatum L., Citrus sp.* L., *Ricinus* etc.
Cadra cautella (Walk.)	Phycitinae	Pyralidae	Flour of cereals, beans of cocoa, groundnut seeds, dates, nutmeg, etc.
Chilo auricilia Dudgeon	Crambinae	Crambidae	*Oryza sativa* L., *Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L. etc.
Chilo batri F.	Crambinae	Crambidae	*Saccharum officinarum* L. etc.
Chilo ikri F.	Crambinae	Crambidae	*Saccharum officinarum* L. etc.
Chilo infuscatellus (Snellen)	Crambinae	Crambidae	*Avena sativa* L., *Hordeum vulgare* L., *Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L. etc.
Chilo kanra F.	Crambinae	Crambidae	*Saccharum officinarum* L. etc.
Chilo partellus (Swinhoe)	Crambinae	Crambidae	*Oryza sativa* L., *Avena sativa* L., *Hordeum vulgare* L., *Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L. *Pennisetum glaucum* (L.) etc.
Chilo polychrysa (Meyr.)	Crambinae	Crambidae	*Oryza sativa* , *Zea mays* L., *Saccharum officinarum* L. etc.
Chilo sacchariphagus indicus (Kapur)	Crambinae	Crambidae	*Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L. etc.

Species	Subfamily	Family	Host range
Chilo suppressalis (Walker)	Crambinae	Crambidae	*Oryza sativa* L., *Sorghum bicolor* (L.), *Zea mays* L., *Saccharum officinarum* L. etc.
Chilo tumidicostalis Hmpsn.	Crambinae	Crambidae	*Saccharum officinarum* L.
Citripestis eutraphera Meyrick	Phycitinae	Pyralidae	*Mangifera indica* L.
Cnaphalocrocis bilinealis (Hmps.)	Spilomelinae	Crambidae	*Oryza sativa* L.
Cnaphalocrocis medinalis (Guen.)	Spilomelinae	Crambidae	*Avena sativa* L., *Pennisetum glaucum* (L.), *Hordeum vulgare* L., *Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L. *Triticum* sp. L. etc.
Cnaphalocrocis poeyalis (Walker)	Spilomelinae	Crambidae	*Oryza sativa* L.
Cnaphalocrocis trapezalis Guen.	Spilomelinae	Crambidae	*Zea mays* L., *Sorghum bicolor* (L.), *Saccharum officinarum* L. etc.,
Conogethes punctiferalis Guen.	Spilomelinae	Crambidae	*Ricinus communis* L., *Zea mays* L., *Sorghum bicolor* (L.), *Carica papaya* L., *Helianthus annuus* L., *Solanum melongena* L., *Citrus limon* (L.), *Elettaria cardamomum* (Maton) etc.
Copamyntis infusella Meyr.	Phycitinae	Pyralidae	*Gossypium* sp.
Coptobasis textalis L.	Spilomelinae	Crambidae	*Gossypium* sp.
Corcyra cephalonica Stainton	Galleriinae	Pyralidae	Grains/flour of cereals, dried fruits etc.
Crocidolomia pavonana Fabricious	Glaphyriinae	Crambidae	*Brassica oleracea* L., B. *juncea* (L.), B.*rapa* L., *Raphanus sativus* L. etc.
Cryptoblabes angustipennella Hamps.	Phycitinae	Pyralidae	*Citrus sp.* L., *Mangifera indica* L., *Psidium guajava* L., *Tamarindus indica* L. , *Triticum aestivum* L. etc.
Cryptoblabes gnidiella Mill.	Phycitinae	Pyralidae	*Oryza sativa* L., *Saccharum officinarum* L., *Sorghum bicolor* (L.), *Zea mays* L.

Species	Subfamily	Family	Host range
			Allium sativum L., *Vitis vinifera* L., *Citrus* sp., *Mangifera indica* etc.
Diaphania indica (Saunders)	Spilomelinae	Crambidae	*Cajanus cajan* (L.), *Cucumis melo* L., *Cucumis sativus* L., *Cucurbita moschata Duchense* ex Poir, *Cucurbita pepo* L., *Gossypium herbaceum Linn*., *Lagenaria siceraria* (Molina), *Luffa acutangula* (L.), *Trichosanthes cucumerina var. anguinea* (L.), *Vigna unguiculata* (L.) etc.
Emmalocera depressella Swinh.	Phycitinae	Pyralidae	*Sorghum bicolor (L.), Pennisetum purpureum Schumach etc.*
Ephestia kuehniella Zeller	Phycitinae	Pyralidae	Flour of cereals, baked goods and other dry grain products etc.
Etiella zinckenella Treit	Phycitinae	Pyralidae	*Cajanus cajana* (L.), *Vigna radiata* (L.) etc.
Euzophera bigella Moore.	Phycitinae	Pyralidae	*Punica granatum* L.
Euzophera perticella R.	Phycitinae	Pyralidae	*Solanum melongena* L.
Glyphodes phyloalis W.	Spilomelinae	Crambidae	*Morus* sp.
Glyphodes pulverulentalis (Hampson)	Spilomelinae	Crambidae	*Morus* sp.
Haritalodes derogate F.	Spilomelinae	Crambidae	*Gossypium* sp.
Hellula undalis Fab.	Glaphyriinae	Crambidae	*Brassica oleracea* L., B. *juncea* (L.), B.*rapa* L., *Raphanus sativus* L. etc.
Hendecasis duplifascialis Hmps.	Cybalomiinae	Crambidae	*Jasminum* spp.
Herpetogramma basalis F.	Spilomelinae	Crambidae	*Amaranthus species and cucurbits*
Herpetogramma phaeopteralis Gr.	Spilomelinae	Crambidae	*Graminaceae species*
Herpetogramma stultalis Walk.	Spilomelinae	Crambidae	*Amaranthaceae species*

Species	Subfamily	Family	Host range
Lamida moncusalis Walker	Epipaschinae	Pyralidae	*Anacardium occidentale* L. and *Mangifera indica* L.
Lamoria adaptella Walk.	Gallerinae	Pyralidae	Onion in store
Lepidogma sp.	Epipaschinae	Pyralidae	*Ficus* sp.
Leucinodes orbanalis Guen.	Spilominae	Crambidae	*Solanum melonginum* L., *Solanum tuberosum* L. etc.
Lygropia obrinusalis walk.	Spilomelinae	Crambidae	*Zea mays* L.
Maruca vitrata (Geyer.)	Spilomelinae	Crambidae	*Cajanus cajana* (L.), *Vigna unguiculata* (L.), *Vigna radiata* (L.), *Glycine max* (L.) etc.
Meliarpha separatella Ragonot.	Spilomelinae	Crambidae	*Oryza sativa* L.
Mussidia pectinicornella H.	Phycitinae	Pyralidae	*Citrus* sp. and *Manilkara zapota* (L.)
Nausinoe geometrolis (Guenee)	Spilomelinae	Crambidae	*Jasminum officinale* L.
Nausinoe pueritia (Cramer)	Spilomelinae	Crambidae	*Jasminum officinale* L.
Nephopteryx eugraphella Rag.	Phycitinae	Pyralidae	*Manilkara zapota* (L.)
Omides diemenalis (Guen)	Spilomelinae	Crambidae	*Glycine max* (L.), *Phaseolus vulgaris* L. and *Vigna radiata* (L.) etc.,
Omides indicata (Fabricius)	Spilomelinae	Crambidae	*Arachis hypogaea* L., *Beta vulgaris var. saccharifera* L., *Chrysanthemum indicum* L., *Glycine max* (L.), *Nicotiana tabacum* L., *Phaseolus vulgaris* L., *Vigna unguiculata* (L.) etc.
Orthaga euadrusalis Wlk.	Epipaschiinae	Pyralidae	Temperate fruits
Orthaga eumictalis Hampson	Epipaschiinae	Pyralidae	*Mangifera indica* L.
Orthaga exvinacea Hmps.	Epipaschiinae	Pyralidae	*Anacardium occidentale* L., *Mangifera indica* L. etc.
Palpita unionalis F.	Spilomelinae	Crambidae	*Jasminum officinale* L.

Species	Subfamily	Family	Host range
Paralipsa gularis Zell.	Galleriinae	Pyralidae	Stored nuts and seeds like walnut, almond, soybean etc.
Paraponyx stagnalis (Zeller)	Acentropinae	Crambidae	*Oryza sativa* L.
Phycita clientella Z.	Phycitinae	Pyralidae	*Gossypium* sp. L., *Solanum melongena* L.
Plodia interpunctella Hub.	Phycitinae	Pyralidae	Flours of cereals, bread, spices or dried fruits, nuts etc.
Saluria inficita (Wlk.)	Phycitinae	Pyralidae	*Eleusine coracana* (L.)
Scirophaga excerptalis Wlk.	Schoenobiinae	Crambidae	Saccharum officinarum L., Triticum spp. etc.
Scirpophaga gilviberbis Z.	Schoenobiinae	Crambidae	*Oryza sativa* L.
Scirpophaga incertulas (Walker)	Schoenobiinae	Crambidae	*Oryza sativa* L.
Scirpophaga innotata (Walker)	Schoenobiinae	Crambidae	*Oryza sativa* L.
Scirophaga nivella (F.)	Schoenobiinae	Crambidae	*Oryza sativa* L., *Saccharum officinarum* L., *Triticum* spp., etc.
Spolodea recurvalis (F.)	Spilomelinae	Crambidae	*Spinacea oleracea* L., *Beta vulgaris* L., *Gossypium* sp., *Zea mays* L. and *Glycine max* (L.) etc.
Stenachroia elongella Hmpsn.	Galleriinae	Pyralidae	*Sorghum bicolor* (L.)
Synclera univocalis Wlk.	Spilomiinae	Crambidae	*Ziziphus mauritiana Lamk.*
Tirathaba mundella Walk.	Phycitinae	Pyralidae	*Areca catechu* (L.), *Mangifera indica* L. etc.
Zonula leuconeurella Rag.	Galleriinae	Pyralidae	*Mangifera indica* L.

= *Phycis recurvella* Zincken, 1818; type locality: Coromandel

= *Spoladea animalis* Guenée, 1854; type locality: Brazil, Pernambuco

Genus: *SYNCLERA* Lederer, 1863; type species: *Eudioptis traducalis* Zeller, 1852

= *Synctera* Möschler, 1886

***Synclera univocalis* (Walker, 1859 :) (*Glyphodes*);** type locality: Sri Lanka

ACKNOWLEDGEMENT

Authors are grateful to Dr. C.A. Viraktamath, Principal Investigator, ICAR Network Project on Insect Biosystematics, Department of Entomology, University Agricultural Sciences, Bengaluru 560 065, for his constant encouragement, constructive suggestions and motivation to carry out work on Pyraloidea.

REFERENCES

Atwal S. and Dhaliwal G. S. (2005) Agricultural pests of South Asia and their Management, Kalyani Publishers, New-Delhi.

Ayyar T. V. R. (1940) Hand book of Economic Entomology for south India. Printed by Superintendent, Government Press, Madras.

Börner C. (1925) Lepidoptera, Schmetterlinge. pp. 382- 421. In: Bröhmer, P. (ed.). Fauna von Deutschland: Berlin: Leipzig, Quelle and Meyer: p 561.

Butani D. K. and Jotwani M.G. (1984) Insects in vegetables. Periodical Expert Book Agency, Delhi, India. p356.

Clark G. J. F. (1941) The preparation of slides of the genitalia of Lepidoptera. Bullettin of Brooklyn Entomological Society, 36.

David B. V. and Ananthakrishan T. N. (2014) General and Applied Entomology. 2nd Edition, Tata McGraw-Hill publishing company Ltd., New Delhi.

David B. V. and Ramamurthy V. V. (2012) Elements of Economic Entomology, Namrutha Publication, Chennai, India.

Fletcher T. B. (1914) Some South Indian Insects and other animals of importance. Printed by the Superintentendent, Governament Press, Madras.

Hampson G. F. (1896) Fauna of British India, Moths, 4: 1-594.Taylor and Francis Ltd., London.

Kirti J. S. and Gill N. S. (2005) Taxonomic studies on Indian species of genus *Maruca* Walker (Lepidoptera: Pyralidae: Pyraustinae). Zoos' print Journal, 20(7): 1930-1931.

Klots A. B. (1970) Lepidoptera, in "Taxonomist's Glossary of Genitalia in Insects" (ed. Tuxen, S. L.), 2. Munksgaard, Copenhagen. p. 115-130.

Lange H. (1956) Aquatic Lepidoptera, pp. 271-288. In: Usinger, R. L. (ed.). Aquatic Insects of California. University of California Press, Berkeley.p. 508.

Latreille P. A. (1809) Genera Crustaceorum et Insectorum: Secundum Ordinem Naturalem in Families Disposita, Iconibus Exemplisque Plurimis Explicate, Paris. 4:1-399.

Lefroy H. M. (1906) Indian Insect pests. Today and Tomorrows Printers and Publishers, New Delhi.

Linnaeus C. (1758) Systema Naturae, 10th ed. Stalkholm.Vol.2.

Mathew G. (2006) An inventory of Indian Pyralids (Lepidoptera: Pyralidae). Zoos' print Journal, 21(5): 2245-2258.

Minet J. (1983) Étudemorphologiqueetphylogénétique des organestympaniques des Pyraloidea. 1. Généralitèset homologies (Lepidoptera Glossata). Annales de la Société Entomologique de France, 19 (2): 175-207.

Munroe E. (1972) Pyraloidea. Pyralidae (in part). In: Dominick R. B., Ferguson D. C., Franclemont J. G., Hodges R. W. and Munroe E. G. (eds.). The Moths of America North of Mexico. London. E.W. Classey, Ltd. and The Wedge Entomological Research Foundation, 1- 304, 1-150.

Munroe E. and Solis M. A. (1999) Pyraloidea. pp. 233-256. In: Kristensen N. (ed.). Lepidoptera, Moths and Butterflies, Vol. 1, Arthropoda, Insect, Vol.4, Part 35. Handbook of Zoology. Walter de Gruyter and Co. Berlin.p. 491.

Nair M. R. G. K. (1971) Insects and mites of crops in India. ICAR, New Delhi.

Pradhan S. (1969) Insect Pests of Crops. National Book Trust, India.

Regier J. C., Mitter C., Solis M. A., Hayden J. E., Landry B., Nuss M., Simonsen T. J., Yen S., Zwick A. and Cummings M. P. (2012) Molecular phylogeny for the pyraloid moths (Lepidoptera: Pyraloidea) and its implications for higher-level classification. Systematic Entomology, The Royal Entomological Society, London. 37 (4): 635–656.

Reddy P. P. (2010) Plant Protection in Horticulture. Vol. I, Insects, Mite and Vertibrate Pests and their Management. Scientific Publishers, Jodhpur, India.

Reddy P. P., Verghese A. and Krishnakumar N. K., 2001, Integrated Pest Management in Horticultural Ecosystem. Capital Publishing Company, New Delhi.

Regupathy A., Chandramohan N., Palnisamy S. and Gunathilagaraj K. (1997) A guide on crop pests. Sooriya Desktop Publishers, Coimbatore, India.

Robinson G. S. (1976) The preparation of slides of Lepidoptera genitalia with special reference to the microlepidoptera. Entomologists Gazette, 27: 127-132.

Solis M. A. (1997) Snout moths: Unraveling the taxonomic diversity of a speciose group in the Neotropics, pp. 231-242. In: Reaka-Kudla M. L., Wilson D. and Wilson E. O. (eds.). Biodiversity II: Understanding and Protecting our Biological Resources. Joseph Henry Press, Washington, D. C. p. 551.

Solis M. A. (2007) Phylogenetic studies and modern classification of the Pyraloidea (Lepidoptera). Revista Colombiana de Entomologia, 33 (1): 1-9.

Thomas E. W. (2007) Entomological notes - Preparing wing slides for microlepidoptera. Michign Entomological Society, 30-31.

(Received 23 March 2015: accepted 20 June 2015

AUTHOR INDEX

Amritha, V. S., 1

Aswini, S., 1

Devanesan, S., 1

Jayaprakas, C.A., 11

Mohandas, C., 11

Nagaraj, S. K., 23

Prabhuraj, A., 23

Sangeetha, B.G., 11

Shankara Murthy, M., 23

Siji, J.V., 11

Statement of ownership and other particulars of ENTOMON

(Form IV, Rule 8 of Registration of Newspapers (Central) Rules 1956)

1.	Place of publication	:	Trivandrum
2.	Periodicity of publication		Quarterly
3.	Printer's name, nationality and address	:	Dr K D Prathapan, Indian, Secretary, Association for Advancement of Entomology, Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani PO, Thiruvananthapuram 695522, Kerala, India
4.	Publisher's name, nationality and address	:	- do-
5.	Editor's name, nationality and address	:	Dr M S Palaniswami, Indian, Chief Editor, ENTOMON, Association for Advancement of Entomology, Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani PO, Thiruvananthapuram 695522, Kerala, India
6.	Name and address of the Individual who owns the paper	:	Association for Advancement of Entomology, Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani PO, Thiruvananthapuram 695522, Kerala, India

I, Dr K. D. Prathapan, Secretary, Association for Advancement of Entomology, here by declare that the particulars given above are true to the best of my knowledge and belief.

Sd/-

Vellayani PO, Thiruvananthapuram 695522
30 June 2015

Dr K. D. Prathapan
Publisher, ENTOMON

Association for Advancement of Entomology

(Reg. No. 146/ 1975)

Department of Entomology, Kerala Agricultural University,
Vellayani PO, Thiruvananthapuram 695522, Kerala, India. E mail: aae@kau.in
web:www.entomon.in

Reg. No. 123SBN

Layout and printing at SB Press (P) Ltd, Trivandrum-1